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VOLUME 47
NUMBER 6


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Published on the 15th of each month by

PALMERTON PUBLISHING COMPANY, INC.

Printing office,
East Stroudsburg, Pa.

Editorial and Advertising Offices,
250 West 57th St., New York City

Entered as Second Class Matter, October 20, 1933 at the Post Office at East Stroudsburg, Pa., under Act of March 3, 1879. Subscription Rates: Domestic, $2.00 a year; Canada, $2.50; Foreign, $3.00. Single copies up to 3 months old, 25 cents; over 3 months old, 50 cents. Telephone COlumbus 5-2923, 5-2924.


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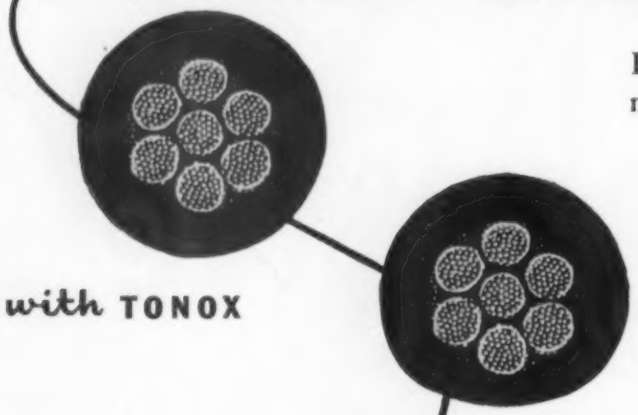
Indexed in Industrial Arts Index. OFFICERS: P. L. Palmerton, President; E. D. Osborn, Vice-President and Secretary; Peter P. Pinto, Treasurer.

# TONOX

## stiffens uncured rubber



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*The* **RUBBER AGE**

**VOL. 47, No. 6** **SEPTEMBER, 1940**

# How Baldwin Rubber Reduced Its Steam Cost from $0.27 to Under $0.20 Per 1,000 Pounds of Coal

**BY SAMUEL R. HUNTER**

*Consulting Power Plant Engineer*

THE old boiler plant of the Baldwin Rubber Company, at Pontiac, Michigan, was composed of three 100 h.p. horizontal return tubular boilers and one 400 h.p. Sterling type unit operating at 100 pounds pressure. These boilers were installed near the center of the manufacturing plant in space badly needed for production purposes. The boilers were all old and had been condemned for further service at 100 pounds pressure. Actually, the steam temperature required for the various vulcanizing and curing operations in this plant was in excess of that corresponding to 100 pounds saturated steam, and as the demand for steam exceeded the capacity of the boilers at safe rating, the only alternative was a complete new boiler plant.

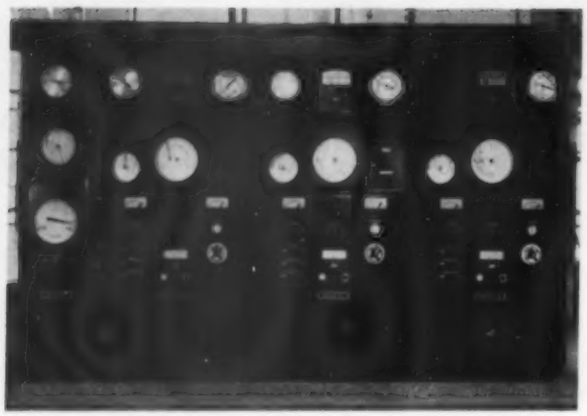
The principal products manufactured by the Baldwin Rubber Company comprise most of the rubber and plastic parts that go on a modern automobile, excepting the tires. Included in these products are rubber floor mats and other sheet, molded and extruded products that require a great volume of steam for curing and processing. Obviously this steam must be clean and free from entrained water and delivered when wanted at uniform temperature.

A study of several months' duration was made to determine: (1) The cost and quantity of steam produced by the old boiler plant as compared to the new plant and of the various types of boilers proposed; (2) The fuel best suited and that most economical for the purpose; (3) The type of boiler; (4) The size and capacity of the boilers required to meet the load fluctuations most efficiently; (5) The steam pressure best suited to the present as well as the future demand; (6) Whether superheat would be of sufficient value to warrant the expenditure if either now or later on it may be decided to install equipment for generating the electricity required but now purchased at approximately .014 per k.w. hr.

Calibrated laboratory meters were installed wherever necessary to determine and record the volume use and flow of steam to the various departments of the plant. These meters were read every 30 minutes simultaneously with electric kilowatt hour meters in order to compare their respective use in these intervals. For the same reason the coal was weighed and all of the records charted for future study.

This study of the performance of the old plant disclosed a requirement of 122,987,200 lbs. of steam over the test control period. This required 15,528,000 lbs. (7,764 tons) of coal at a cost of $33,481.25 or a steam cost of $0.272 per 1,000 lbs. During this period 4,188,440 k.w. hrs. of electricity was purchased at a total cost of $60,627.30—an average k.w. hour rate of $0.0145.

This test proved that the use of steam and electricity was for all practical purposes concurrent, and it was then decided to install boilers designed for 450 lbs. pressure and 150 degrees of superheat and to later install extracting type steam turbines directly connected to suitable generators. The study also disclosed the steam requirements of this plant to be very highly fluctuating. It also indicated the boilers' capacity and the rating at which they must operate to meet the



*All motors pertaining to the boiler operation are controlled by this instrument board. Steam flow is integrated, indicated and recorded. $CO_2$ is indicated and recorded. Steam and exit gas temperature is recorded. Steam pressure is indicated and recorded. Use of a single panel enables the operator to take care of the plant from a central location.*

exacting demands to be imposed on them in the most economical manner. All of the foregoing factors were studied to determine the most economical fuel and method of firing.

Due to the continuous but widely fluctuating demand for process steam, continuity of operation was considered by the management to be of greater importance than extreme economy in operation or cost of the equipment itself, as even a short forced shutdown for repairs would be extremely costly. A failure of steam supply would shut down the plant and the material in process would be almost a total loss. The cost of the equipment was then considered of secondary importance, and the engineers were instructed to "design a boiler plant that would without unnecessary extravagance best meet the unremitting demand for steam."

These instructions could, doubtless, have been met with boilers of oversize capacity and operated at low rating with corresponding sacrifice in economy, but a continued study finally indicated the size and capacity that would be both reasonable in first cost as well as economical in labor and fuel requirement.

The total hourly load requirements were found to be quite uniform throughout the year, although the plant itself might be required to run fewer hours per day to meet curtailed production demands. This led to a decision to install three low head, three drum boilers of 30,000 lbs. steam capacity guaranteed to operate at 225% of rating continuously. Two of these would carry the present load with the third unit serving as stand-by; the boilers to be operated on an equal hour schedule so the use and service would be uniform.

Other controlling factors in the choice of boilers of this type were simplicity of design, fast steaming ability, ease with which repairs may be made, ample water storage capacity, a properly designed furnace, a high evaporation rate, and corresponding high efficiency at comparatively low ratings.

It seemed obvious from the time the load fluctuations were determined, that the fuel used must be one that would follow, almost instantaneously, the up-and-down requirement for steam, or the steam cost would be excessive due to waste of fuel when the steam demand was low, with a corresponding lack of fuel in the furnace when the load suddenly came on.

The rate of fluctuation in steam demand was found to range from 7,500 to 30,000 lbs. several times an hour, and it was very apparent the fuel used, as well as the water level, would have to be under very positive but sensitive control.

The choice of fuel and method of firing seemed to be confined to gas or oil (either of which would respond almost instantaneously to the controlling medium) or to pulverized coal. The cost of gas from a thermal viewpoint was eliminated due to the excessive cost. Oil was then investigated, an ample supply of which was available within easy trucking distance from nearby refiners. It was necessary to guard against soot and flyash, and oil seemed to meet all of the requirements up to the time of signing a contract for an unfailing supply.

Proposals were submitted by local refineries for a residual fuel with a heat value of 155,000 B.t.u. per gallon at $0.045 a gallon delivered at the boiler plant. The cost of steam per 1,000 lbs. was computed on a fuel value basis, and compared to coal offered at $4.40 per ton delivered with a heat value of 14,000 B.t.u. per lb. dry basis. The unloading cost of oil and coal would be comparable, with coal favored in the winter when the oil would require preheating before it could be pumped out of the truck tank.

On a basis of an estimated use of 10,000 tons of 14,000 B.t.u. coal per year, at $4.40 a ton, delivered, the cost comparison with 155,000 B.t.u. oil at $0.045 a gallon would be over $29,000.00 in favor of coal in fuel cost alone and after a liberal allowance had to be made for better boiler efficiency using oil for fuel.

Facilities for unloading, storing and handling coal and ashes, including firing equipment, were found to be over $35,000.00 higher in cost than for oil handling and storing equipment. (The company already owned suitable oil storage tanks). As the additional cost would be amortized in less than two years out of the difference in fuel cost, and since the labor cost would be the same, that is, one man for each eight-hour shift (although the actual labor with coal would be somewhat greater), it was decided to install stokers and burn coal.

Consideration was given to all types of coal firing equipment. Due to the heavy load swings it was early apparent that a spreader type stoker, using ¾-inch screenings, would come nearest to meeting the exacting requirements. While the coal size is designated as ¾-inch screenings, it actually ranges in size from dust to 1¼-inch. Draft is induced with a 30 h.p. motor, and forced draft with a 15 h.p. motor, both directly connected.

The air for combustion is taken from near the boiler room ceiling and forced downward through an air pre-heater from which an air duct extends through the floor and to the rear of the air-tight ash hopper. The temperature of this air is held at approximately 300° F. by means of an automatically controlled by-pass. The over-fire air is by-passed around the air pre-heater and carried downward to the rear of the setting, then through a rectangular duct that extends the full length of the grates where it connects with the front wall of the setting, and upward in the front wall to four over-the-fire openings.

The boilers are set high enough to effect turbulence

and long flame travel without high velocity. In this way most of the fuel is actually burned in suspension with very little carry-over of partly burned particles that would otherwise go up the stack in the form of "flyash" or finely divided coke and clinkers. Long flame, slow burning, is further assured by suitable baffling. Some combustible is carried over when the boilers are operated at higher ratings. At such times a $CO_2$ of 13% is held with but slight variation in spite of the widely fluctuating use of steam.

The fuel carry-over, consisting of finely pulverized coke, is collected in the hopper underneath the air-pre-heater from where it is inducted back into the furnace. The more finely divided flyash is collected by the induced draft fans by means of "skimmers" in the fan housings and by cyclones. This flyash is highly combustible and it is carried back by gravity and burned in the furnace. How thoroughly the fuel is consumed is indicated by the faint gray haze that issues from the stack when the boilers are operating at 225% of rating.

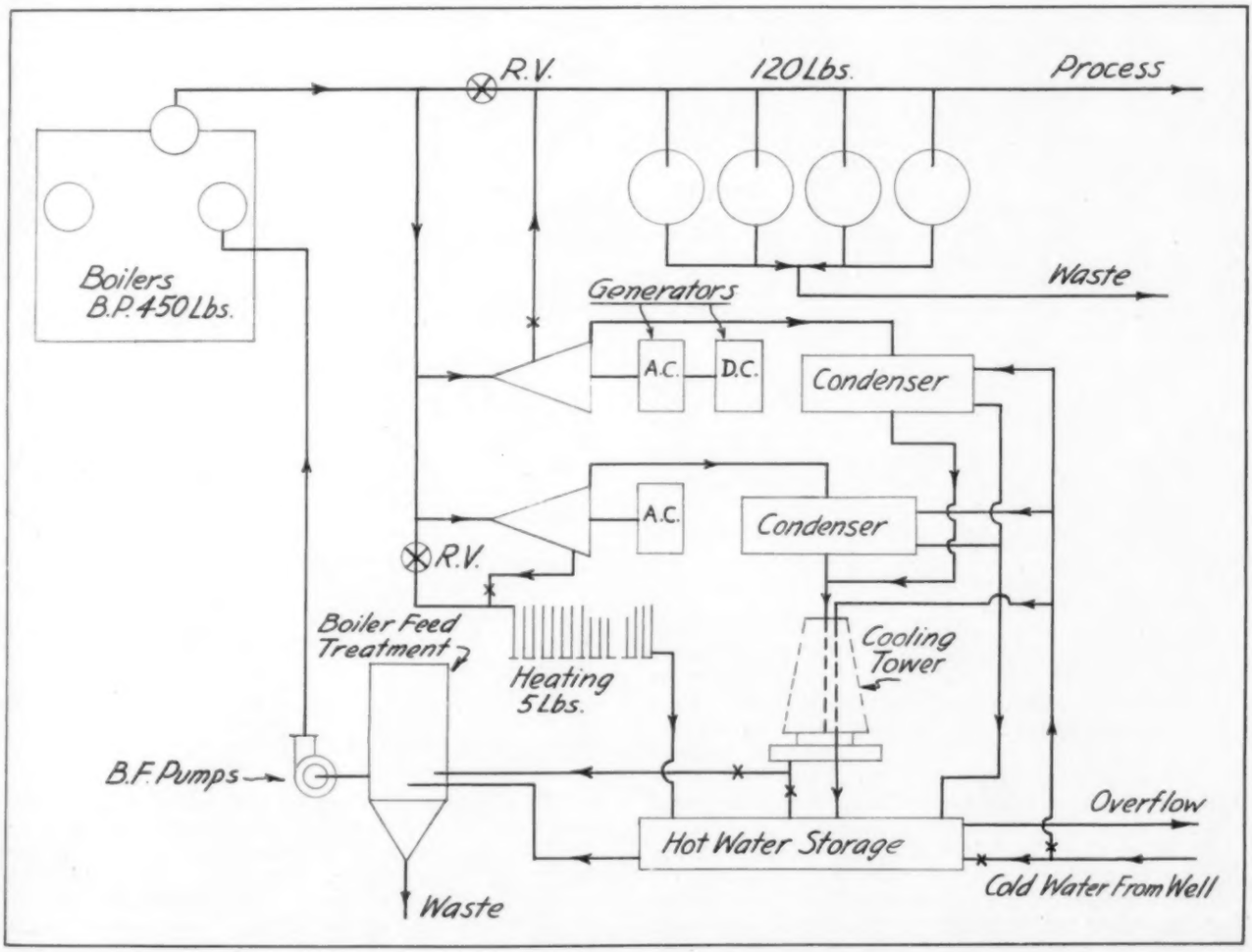
The stokers are supplied from a motor driven weigh larry that handles a ton of coal on each trip. The stoker hoppers have a capacity of 2,300 lbs. each. All coal is weighed and a record made from a print-o-meter scale. The stoker grates are sectional, dumping the ash directly into the air tight pit, from which it is conveyed hydraulically to the ash collector outside of the building.

In order that the boilers may be capable of continuous and satisfactory operation at light load, the rear and front walls were left bare, the sides only being water cooled. Sectionally supported and heavily insulated air-cooled walls are used throughout, with brick encasement.

The flow of air and fuel feed is controlled by means of an automatic control system. The boilers are designed for a working pressure of 450 lbs. and 725° total temperature, but they will operate at 140 lbs. until the high pressure electric generating units are installed.

Due to the wide and sudden fluctuation mentioned in the steam demand, and to the limited steam storage capacity of the three drum boilers, the control of the water level was indeed a difficult problem to solve. The normal water level should be maintained at, or just above, the horizontal center line of the upper boiler drum, with the two lower drums fully submerged at all times.

Obviously, a reliable positive as well as a sensitive control was necessary here to provide for the tremendous out-go of steam and to compensate for the




*Steam flow sheet of the boiler plant of the Baldwin Rubber Company at Pontiac, Michigan*

intermittent swell and shrinkage of the water that occurs coincident with the swings of steam demand. To meet adequately this requirement, it was apparent some dampening effect must be incorporated in the design of the water level control and supply before the boilers could be operated with any degree of safety or satisfaction.

To meet these exacting conditions it was decided to hold the water at a lower level while the boilers were operating on a low load cycle. This enabled the sudden swell to be provided for with no danger of carry-over into the super-heater header and to the turbine steam line where the entrained moisture would have a serious damaging effect on the turbine blading, as well as on the extracted steam that was to be used for process. As soon as the heavy demand for steam is terminated, the receding water level provides more steam space to act as a reserve for additional steam to again meet the next heavy and almost instantaneous demand.

## Dangerous Low Levels Avoided

With this control method no dangerous low levels have been encountered, nor has the pressure of the steam fluctuated enough to have any noticeable effect. To meet these boiler water level characteristics, a two element feed water regulator was selected, one element designed to respond to the rate of steam flow, and the other to the variations in water level, the position of the valve controlling the water supply being in turn controlled by the resultant of the forces of the water level and steam flow.

Instead of taking the measurement of the steam by means of the pressure drop to the super-heater outlet, it is taken across the orifice of the steam flow meter. While in operation the steam flow swings over a 3 to 1 range, at the same time the boiler water level is held within a 4-inch variation. The two boiler feed pumps selected are duplex reciprocating, capable of supplying water against 500 lbs. pressure, each controlled by a governor.

The twenty-four hour daily average water make up is 60% of the total used. This water is taken from the company's wells and is treated with hot lime and soda and supplied to the boiler feed pumps at 190°. No returns from the process operations are used due to sulphurous acid contamination. Provision has been made for a 250,000 gallon water storage to be supplied by the turbine condensers, when they are installed. When this is completed the cost of heating the make up water will be greatly reduced.

An extension was made in the plant switch track and a track hopper installed, so the coal could be unloaded by gravity and conveyed (at a rate of 30 tons per hour) to a 180-ton steel live storage bunker. Provision is made to store 220 tons in a bin located directly underneath the steel bunker. The steel storage bunker is designed so the coal can be fed by gravity directly into the one-ton motor-driven weigh larry that conveys the coal to the stoker hoppers.

In order that the boiler plant be operated at the highest efficiency, a control panel was installed on which is mounted steam flow meters, of the integrating, recording and indicating type. Records are kept of steam pressure and temperature, as well as the rate of flow. The per cent of $CO_2$ is both indicated and recorded, as is also the exit gas and under-fire air temperature. All controls are mounted on one instrument panel. This enables the operator to take care of the plant from a central location. The top of the coal hoppers are about ten feet off the floor and the operator literally operates the plant without seeing either coal or ash.

As three drum boilers operating under such a fluctuating load are subject to some vibration, the boiler steel footings were set so the boiler framing is independent from the building and one inch clearance was left in the floor around the boilers and filled with plastic cement. This provision entirely eliminated all building vibration regardless of load carried.

The present boiler capacity can be expanded 33⅓% by the addition of a fourth boiler in a space already provided. The management of the company have a far-sighted policy that dictated a design that could be further extended in capacity by a duplicate plant that would be served by the present coal and ash handling equipment.

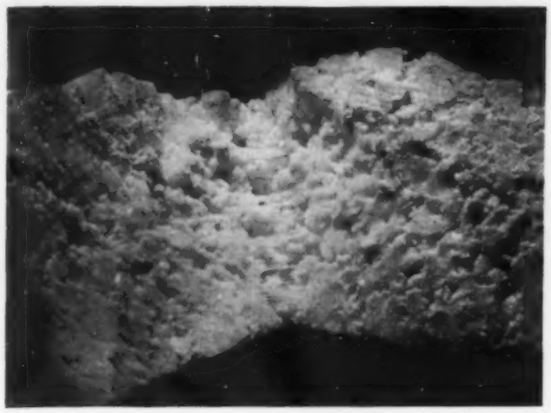
The concurrent use of steam and electricity will make it possible for this company to pay for all of the necessary electric generating equipment in less than two years out of savings alone. When this is done the process steam would, in fact, be a by-product of the generating plant.

Adhering strictly to the consultant's policy, no untried or "just as good" equipment has been used and no freak design permitted. Every piece of equipment used came from a reliable, established manufacturer and the remarkable economy shown by this plant is in part due to this precaution. Another important factor entering into the unusually good performance of this plant is that the boiler plant is in the hands of an exceptionally well-trained operating crew. These men were transferred from the old boiler plant, and with no "breaking in" of either personnel or equipment they put the boilers on the line without an hour's loss of time.

As the space occupied by the old boilers was desirable for manufacturing purpose, and, further, as the plant operations could not be interrupted when the time came to make the change-over from the old to the new plant, it was decided to build a new boiler plant which could be so located as to enable it to expand to take any future growth of the plant without conflicting with any other plant expansion. This arrangement would also enable the future turbine room to be built alongside the boiler house, with the coal storage equipment at the opposite end of the building. The boiler house was designed so the ground floor could be used for the installation of steam driven, high pressure pumps, accumulators, air compressors, etc., with the boilers actually installed on the second floor.

## 82% Average Efficiency Achieved

These boilers were put on the line in April, 1938, and have been in operation almost continuously ever since—with practically no maintenance cost for either boilers or furnace lining. Evaporation in the old plant was under 8 to 1, while the new evaporation rate averages better than 11 to 1. The average cost of steam has been reduced from $0.27 to less than $0.20 per 1,000 lbs. with coal at $4.40 per ton in the bin.



*Crude butyl rubber for which the claim is made that it is a "radical departure from the conventional approach to the problem of supplying the nation's need for synthetic rubber."*

# Manufacture and Properties of Butyl Rubber

THE One Hundredth Meeting of the American Chemical Society is being held in Detroit, Michigan, as this issue goes to press. A report of the general meeting of the Society as well as the sessions of the Division of Rubber Chemistry, the complete program for which appeared in the last issue, will appear in the next issue.

As the convention opened, Dr. Per K. Frolich, Director of the Chemical Division of the Esso Laboratories of the Standard Oil Development Co., presented the first technical report on butyl rubber, the synthetic which is said to be made easily and directly from petroleum. Data on butyl rubber has been a closely guarded secret since its availability was first revealed by W. S. Farish, president of the Standard Oil Company of New Jersey, last June.

Dr. Frolich revealed that the new process climaxes ten years of cooperative effort by the Standard Oil research, development and management units, carried on entirely independent of any other synthetic rubber development either in this country or abroad. The United States military authorities have been kept informed of progress, he explained, and for two years tests have been conducted to evaluate butyl rubber for specialized defense purposes. These tests will continue. Butyl rubber is currently produced from petroleum in a semi-commercial pilot plant by processes more direct and simple than those required for production of other synthetic rubbers, it was stated.

"The Esso Laboratories are still busy evaluating butyl rubber for as many of its potential uses as possible by such tests as can be devised," said Dr. Frolich, who delivered the paper in collaboration with R. M. Thomas, I. E. Lightbown, W. J. Sparks, and E. V. Murphree.

"Because of the dominating importance of the automobile tire field as an outlet for rubber, tests were undertaken on a small scale early in the development to answer the question as to whether or not butyl rubber had any possibilities in this direction. Most of the efforts, however, were concentrated on problems involved in the manufacturing process.

"When the future supply of natural rubber became a matter of national concern, Standard was requested by the Army and Navy Munitions Board to cooperate with one or more rubber companies to the end that the suitability of butyl rubber for tire manufacture could be determined at the earliest possible moment. Such a program was promptly undertaken and is still in progress."

Butyl rubber, a 100 per cent petroleum hydrocarbon product, is a "radical departure from the conventional approach to the problem of supplying the nation's need for synthetic rubber," Dr. Frolich declared. Distinctive characteristics of the new synthetic include greater ability to stretch than natural rubber; remarkable stability and durability; freedom from impurity, taste and odor; lack of color; good age, tear and abrasion resistance; amazing resistance to mineral acids, and unusual electrical properties.

Because petroleum and rubber are built up of the same two chemical elements, carbon and hydrogen, the Standard Oil Development Company became interested in synthetic rubber possibilities. "It would seem," Dr. Frolich pointed out, "that the petroleum industry with its abundant supply of low cost hydrocarbons is in the best position to supply our needs of synthetic rubber."

The fundamental chemical difference between natural and butyl rubber is that the natural rubber molecule is highly "unsaturated", while the butyl rubber molecule is unsaturated only just enough to allow it to be vulcanized, and no more. This control of unsaturation is the key to butyl rubber's distinctive properties.

The degree of unsaturation of a chemical compound measures its ability to unite with certain other elements or compounds without elimination of any side product. The vulcanization of natural rubber is made possible by the chemical unsaturation of the rubber molecule which permits reaction with sulfur to take place in such a manner that the long molecular chains are tied or linked together into a firm structure.

Nature's rubber is made up of extremely long, chain-like molecules in which the atoms are so arrang-

ed that a product is obtained with a high degree of elasticity. Rubber, however, does not have much mechanical strength until it has been vulcanized.

"The reason why rubber has become one of our most valuable and widely used structural materials can be attributed to two of its molecular characteristics—elasticity and unsaturation," Dr. Frolich explained. "However, this very chemical unsaturation which is so essential from the standpoint of vulcanization is also the greatest shortcoming of rubber for the reason that there is too much of it.

"Rubber is so highly unsaturated that it remains unstable and chemically reactive even after it has been combined with the small amount of sulfur normally required in the vulcanization process. If we try to use enough sulfur to overcome this difficulty, we obtain hard rubber or ebonite—which obviously is not the answer for the production of elastic and pliable rubber goods.

"In spite of the remarkable progress which has been made in rubber technology in the last decades, it has not been possible to prevent rubber articles from continuing to combine with chemically reactive agents. The most serious manifestation of this is the well-known deterioration of rubber on aging, due to chemical attack by oxygen from the air. Just as a spare tire loses more and more of its potential road mileage as it grows older, so all of our many rubber household articles, including rubber-insulated electric wiring, gradually deteriorate until they have to be replaced.

"Nature's rubber molecule and all its synthetic semblances are either wholly or predominantly polymers, or multiples, of much smaller molecules which belong to a class of highly unsaturated compounds called diolefins. It is to this diolefinic origin that the natural and synthetic rubbers owe their extreme degree of unsaturation and resultant chemical reactivity.

"Chemists working on rubber have been inclined to associate the elasticity and other important physical properties of rubber with its chemical unsaturation. Chemists in the Esso Laboratories, however, in their studies of chain-like polymers with no residual unsaturation, recognized a majority of these important rubber-like properties. Polymers with no residual unsaturation may be made by uniting the simple olefins, or compounds, which are readily available as constituents of petroleum refinery gases. But these olefins because of their saturated character resist all efforts to vulcanize them with sulfur.

## No Residual Chemical Unsaturation

"Through long years of research by a large group of men, the Esso Laboratories have now developed a method of co-polymerizing olefins with small amounts of diolefins to give just the proper degree of unsaturation for vulcanization—but no more. Out of these efforts has come butyl rubber which after vulcanization is a product with substantially no residual chemical unsaturation. As a result, butyl rubber is characterized by a remarkable stability and durability which for many purposes make it superior to natural rubber and to other synthetics.

"By variations in the composition of the raw materials employed, it is possible to obtain products that differ considerably in their detailed properties, but the basic characteristic remains the same insofar as the limited unsaturation is concerned."

Dr. Frolich pointed out that there is a definite economic advantage in being able to utilize largely the simple olefins from refinery gases rather than the more expensive highly purified diolefinic materials employed so far in the manufacture of synthetic rubbers.

"Aside from its practical value, the discovery of the butyl rubber process will have far reaching theoretical consequences," he continued. "It will automatically eliminate a great many speculative theories concerning the factors contributing to rubber-like properties and in so doing it will help to clarify and simplify our concepts. This in turn may be expected to act as a stimulus to further progress in the field of rubber technology."

## Colorless, Odorless and Tasteless

Representing a radical departure from natural rubber and other synthetic rubbers, butyl rubber differs from these products in many apparent respects, according to Dr. Frolich. Because of its freedom from impurities insofar as these can be detected by ordinary chemical analysis, butyl rubber is colorless, odorless, and tasteless.

"Since, like natural rubber, it is a hydrocarbon, butyl rubber definitely does not belong in the class of synthetics that are resistant to swelling in petroleum solvents," Dr. Frolich added. "Somewhat paradoxically, however, it is more resistant to such simple aromatics as benzol and toluol than even the synthetic rubbers now employed in the construction of gasoline dispensing hose. It is more resistant than natural rubber to many oxygenated compounds and to certain other solvents, such as ethylene dichloride.

"By some modification of the technique employed, butyl rubber may be processed and vulcanized in much the same manner as natural rubber. It may be compounded, either heavily or lightly, to obtain any type of stock, but in general it vulcanizes somewhat more slowly than natural rubber. It may be more highly loaded with carbon black and other pigments to give products of a given hardness, and this is an economic advantage.

"The tensile strength of butyl rubber is comparable to that of natural rubber in compounds which do not contain carbon black. As butyl rubber stretches much more than natural rubber for a given load, its strength per unit cross-sectional area at the point of break is actually much greater. Its tensile strength is not increased to the same extent as for natural rubber on the addition of large volumes of carbon black, but other properties such as tear resistance and abrasion resistance are affected in much the same way as in the case of natural rubber.

"Butyl rubber is readily molded even into articles of intricate design, and its good tear resistance is an aid in removing such products from the hot mold. Its abrasion resistance may be made comparable to that of natural rubber, and it is also more resistant to continued flexing both hot and cold. Indeed, it will flex without cracking at a lower temperature than any other rubber, natural or synthetic.

"Although butyl rubber is more age-resistant than natural rubber, it is advisable to add carbon black to prevent butyl rubber from becoming tacky on continued exposure to direct sunlight. Such carbon black compounded stocks are considerably more sunlight resistant than natural rubber.

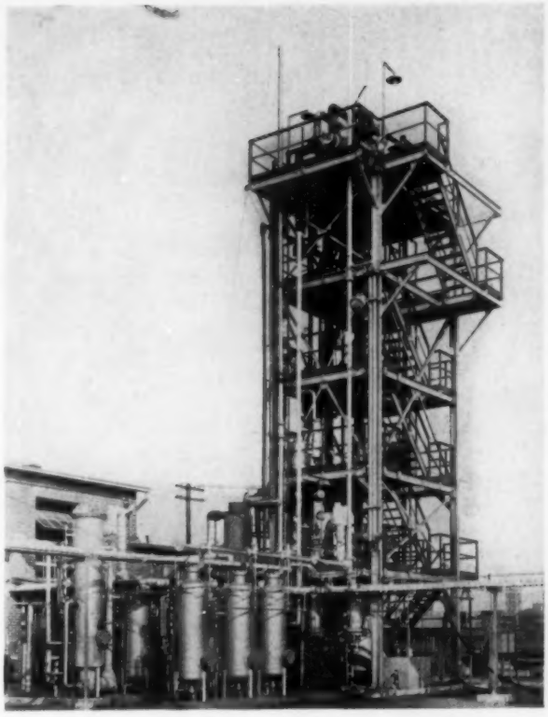
"Further manifestations of butyl rubber's saturated character are its remarkable resistance to strong mineral acids and its unusual electrical properties. Hot concentrated nitric acid, for example, has no visible effect on the new product during a time interval which is sufficient to make a similar sample of natural rubber disappear completely. As an insulating material it is superior to all other types of rubber, and its electrical properties are not adversely affected on immersion in water.

"Butyl rubber is less permeable to both chemically active and inactive gases than natural rubber. Thus, it is many times as resistant to penetration of such gases as hydrogen and helium. It bounces much less than natural rubber at room temperature, but as the temperature is increased to 200 degrees Fahrenheit the rebound approaches that of natural rubber."

Originally, the goal of chemistry was to synthesize a product that would equal natural rubber in those properties which have contributed to make it one of the most important structural materials, Dr. Frolich said. The more recent trend, however, is to synthesize materials closely resembling Nature's product in some respects, while at the same time surpassing it in others.

"In the light of the achievements to date," he concluded, "we are justified in looking forward to the development of a series of synthetics, each one of which will exceed natural rubber in certain specific properties, so that in the aggregate these products will give us something superior to rubber as we know it today. We believe that butyl rubber possesses properties which will secure an important place for it in this synthetic picture.

"Future manufacturing plans will be dependent somewhat upon tests now in progress and to be undertaken more widely when the material is distributed among prospective users. The program which is being followed with respect to the evaluation of the product for commercial uses is to some extent being governed by national defense considerations."



*View of the butyl rubber pilot plant.*

# Use of Latex for Soil Preservation

AN interesting process which makes use of latex, or other materials, to provide for the consolidation of earth, subsoil sand, masonry, concrete and similar natural or artificial foundations essentially porous in structure, is the subject of a recent U. S. patent (No. 2,197,843). Object of the process is to produce a coherent mass, impervious to seepage and resistant to destruction by various contained or surrounding liquids or gases. It finds special application in construction projects where part of the foundation is under water, as in dikes or breakwaters, but may also be employed to "set" river beds and the banks of streams so as to prevent erosion.

According to the patent, the process consists of mixing a solution of latex with some hydrocarbon, such as kerosene oil or benzene, and introducing the resultant mixture into the mass which is to be consolidated by means of pipes or similar devices. Precautions must be taken to insure proper and complete dispersion within the mass. The action of the oil upon the latex particles causes them to swell and to fill up the air spaces, thus rendering the complete mass resistant to water or whatever the surrounding medium may be. This swelling process may be time controlled by the addition of accelerators, vulcanizing agents and other compounding ingredients. Casein, for example, has been successfully employed by the patentee to slow down the swelling action.

Several investigations indicative of the practicability of the process are given in the patent. In one, the bed of a river is to be "fixed" to prevent shifts in the channel, etc. In this instance, a mixture of one part of latex and four parts of a mixture of 80% kerosene and 20% benzene is introduced by means of a pipe running down to a bell-shaped appliance placed on a section of the river bottom. The mixture is pumped down through the pipe in such manner that it penetrates the sandy bottom to a slight depth. The slow action of the oil upon the latex causes the particles to swell and thus "tightens" the river bed. Numerous applications to adjacent sections of the bed results in a coherent mass which prevents shifts in the channel.

In another case, the joints of a breakwater and the loosely-piled stone dumpings at its base on the sea floor are filled up by an injection pumped through a series of pipes reaching to the bottom. Here the mixture consists of 10 parts of latex and 15 parts of a creosote oil-bitumen dispersion in a .03% soap solution, to which is added a finely ground filler material. In this instance, the swelling of the latex particles induced by the oil present is amplified by the additional swelling of the filler material acted upon by the soap solution.

# Preliminary Census Figures for 1939 on the Tire and Tube Industry

MANUFACTURERS of rubber tires and inner tubes, in the United States, reported a moderate decrease in employment, a slight decrease in wages, and a slight increase in production, for 1939 as compared with 1937, according to preliminary figures, compiled from returns of the Census of Manufactures for 1939 and released by Director William Lane Austin, Bureau of the Census, Department of Commerce.

This industry, as constituted for Census purposes, includes establishments primarily engaged in the manufacture of pneumatic tires and inner tubes, and solid and cushion rubber tires for any class of vehicle.

The wage earners, primarily engaged in manufacturing in this industry in 1939, were 54,115, a decrease of 14.5 per cent compared with 63,290 reported for 1937; and their wages, $89,773,503, were less than the 1937 figure, $96,706,731, by 7.2 per cent. These decreases, in the number of wage earners and wages, may be partially accounted for by the fact that the 1939 Census of Manufactures questionnaire for the first time called for personnel employed in distribution, construction, etc., separately from the manufacturing employees of the plants.

It is not known how many of the wage earners reported in 1937 were engaged in distribution and construction and how many were engaged in manufacturing. Employees of the plants reported as engaged in distribution and construction activities for 1939 are not included in this preliminary report but will be included in the final report. The value of products of the industry for 1939 amounted to $580,928,993, an increase of 0.9 per cent as compared with $575,860,262 reported for 1937.

Summary statistics for 1939 and 1937 are presented in Table 1. Detailed statistics on production are given in Table 2. All figures for 1939 are preliminary and subject to revision.

TABLE 1.—SUMMARY FOR THE INDUSTRY: 1939 AND 1937

| | 1939 | 1937 | Percent of increase or decrease (—) |
|---|---|---|---|
| Number of establishments | 53 | 46 | (*) |
| Salaried personnel[1] | 9,016 | 10,952 | —17.7 |
| Salaries[1,2] | $ 23,250,768 | $ 25,323,979 | — 8.2 |
| Wage earners (average for the year)[3] | 54,115 | 63,290 | —14.5 |
| Wages[2,3] | $ 89,773,503 | $ 96,706,731 | — 7.2 |
| Cost of materials, supplies, fuel, purchased electric energy, and contract work[2] | $349,286,866 | $366,858,443 | — 4.8 |
| Value of products[2] | $580,928,993 | $575,860,262 | 0.9 |
| Value added by manufacture[4] | $231,642,127 | $209,001,819 | 10.8 |

* Percent not computed where base is less than 100.
[1] No data for employees of central administrative offices are included.
[2] Profits or losses cannot be calculated from the Census figures because no data are collected for certain expense items, such as interest, rent, depreciation, taxes, insurance, and advertising.
[3] The item for wage earners is an average of the number reported for the several months of the year and includes both full-time and part-time workers. The quotient obtained by dividing the amount of wages by the average number of wage earners should not, therefore, be accepted as representing the average wage received by full-time wage earners.
[4] Value of products less cost of materials, supplies, fuel, purchased electric energy, and contract work.

TABLE 2.—PRODUCTS, BY KIND, QUANTITY, AND VALUE: 1939 AND 1937

| | 1939 | 1937 |
|---|---|---|
| 1. Rubber Tires and Inner Tubes industry, all products, total value | $580,928,993 | $575,860,262 |
| 2. Rubber tires and inner tubes, value | $497,636,438 | $478,770,897 |
| 3. Other products not classified in this industry | $ 83,292,555 | $ 97,089,365 |
| Tires and inner tubes, total value | $497,636,438 | $478,770,897 |
| Pneumatic tires and casings: | | |
| Motor-vehicle, except motorcycle and bicycle: | | |
| Total number | 58,372,275 | 54,113,445 |
| Total value | $435,303,639 | $412,765,798 |
| Passenger-car: | | |
| Number | 49,166,077 | 45,668,599 |
| Value | $269,241,421 | $253,270,878 |
| Truck and bus: | | |
| Number | 8,178,568 | 7,702,436 |
| Value | $155,834,737 | $156,459,385 |
| Airplane: | | |
| Number | 30,405 | 32,710 |
| Value | $ 544,823 | $ 667,985 |
| All other: | | |
| Number | 997,225 | 709,700 |
| Value | $ 9,682,658 | $ 2,367,550 |
| Motorcycle and bicycle: | | |
| Single-tube tires: | | |
| Number | 1,655,503 | 1,654,216 |
| Value | $ 1,202,485 | $ 1,390,700 |
| Casings: | | |
| Number | 4,557,455 | 3,402,263 |
| Value | $ 3,384,735 | $ 3,191,864 |
| Inner Tubes: | | |
| Passenger-car, truck, and bus: | | |
| Number | 51,016,763 | 52,372,908 |
| Value | $ 52,510,944 | $ 55,739,387 |
| Airplane: | | |
| Number | 27,192 | 25,026 |
| Value | $ 104,961 | $ 101,912 |
| Motorcycle and bicycle: | | |
| Number | 4,404,351 | 3,397,286 |
| Value | $ 1,532,157 | $ 1,186,697 |
| All other: | | |
| Number | 645,737 | 167,906 |
| Value | $ 1,343,332 | $ 470,135 |
| Solid and cushion tires, all types, value | $ 2,254,185 | $ 3,924,404 |

# The Standardization of Durometers

By LEWIS LARRICK[1]

THE hardness test is one of the most useful and convenient physical tests which can be made on vulcanized rubber. It is easily made because the equipment can be simple, compact, and portable. It is particularly useful in that the test sample may be a production article which can be put into service, undamaged, after the test. Consequently the test appears in the industry in several modifications, and the tester in diverse styles.

Several more or less readily portable hardness testers are available commercially. The Shore Instrument and Manufacturing Co. has its line of "Durometers," types A, B, C, D, etc.; Schopper, through Testing Machines, Inc., has marketed a tester similar to the Shore type A; the U. S. Gauge Co. has an instrument of the same type using the case of their pressure gage; the Firestone Penetrometer is another well-known tester of the spring-load type, as is the Adams Densimeter. At the present time the Society's Committee D-11 on Rubber Products is studying four portable hardness testers which are based on the specifications of the Standard Method of Test for Hardness of Rubber (D 314-39) *(2)*, three of these being spring-operated instruments, the fourth, a dead-load type. In addition to the testers mentioned above, there is the Pusey-Jones Plastometer, which is a dead-weight hardness tester rather than a plastometer.

Generally speaking, portable hardness testers are spring-operated. Beyond this feature they have little in common with each other or with either the A.S.T.M. tester (D 314) or the Pusey-Jones Plastometer (D 531-39 T) *(3)*. Figure 1 gives an indication of the disparity of results obtained with some of these instruments.

The situation is little better when a comparison is made of several durometers made by the same manufacturer, as can be seen in Fig. 2, showing the hardness of one sample of rubber as measured by 20 instruments which were in use in one factory. If the hardness of this compound were specified as 65 ± 2, which is a common tolerance, the sample would have been rejected by eight of the durometers.

Further indications of the lack of agreement among durometers may be found in the discussions of the Society's Committee D-11. It is evident that a technique of standardization is necessary and that the fundamental principles should be known to designers and users. This paper presents a resumé of the theoretical laws of penetration of a material such as vulcanized rubber, and their application in standardizing Shore Type A durometers as an example of one of the widely used hardness testers. Suggestions are made for an improved type of hardness tester.

## Theoretical Basis

It has been found *(4)* that the penetration of vulcanized rubber by rigid spherical indentors follows the laws of classical elasticity for indentations as high as 10 per cent of the diameter of the indenting sphere. At 20 per cent the measured penetration is not much greater than that predicted by the theory. Theory and experiment show that:

1. If a rigid spherical indentor is pressed into an isotropic elastic material, the penetration $d$ is propor-

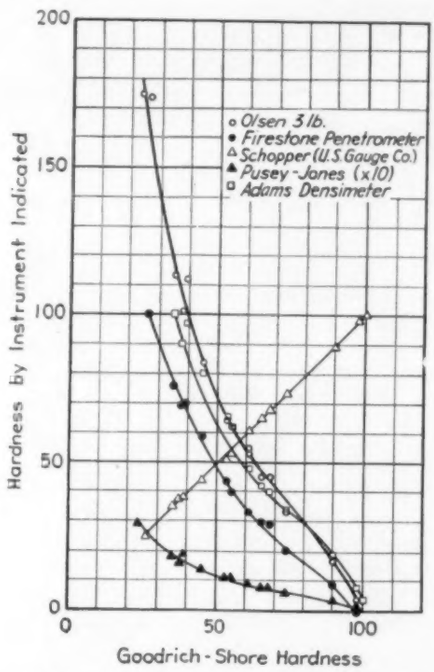



*Fig. 1—Intercon Version of Hardness Readings*

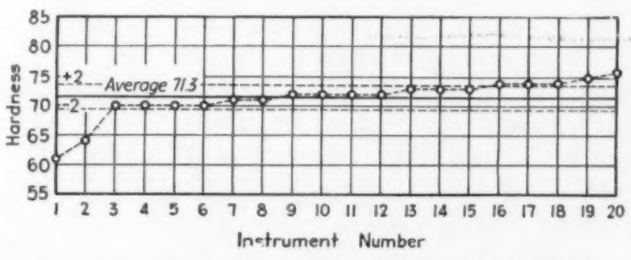



*Fig. 2—Comparison of Type A. Shore Durometers*

Note: This paper was delivered at the meeting of Committee D-11 on Rubber Products of the A.S.T.M., held in Atlantic City, N. J., on June 28, 1940.

(1) Physical Research Laboratory, The B. F. Goodrich Co., Akron, Ohio.
(2) 1939 Book of A.S.T.M. Standards, Part III, p. 347.
(3) *Ibid.*, p. 855.
(4) Lewis Larrick, "The Hardness of Rubber and Other Highly Elastic Materials," *Physical Review*, Vol. 57, p. 358 (1940).

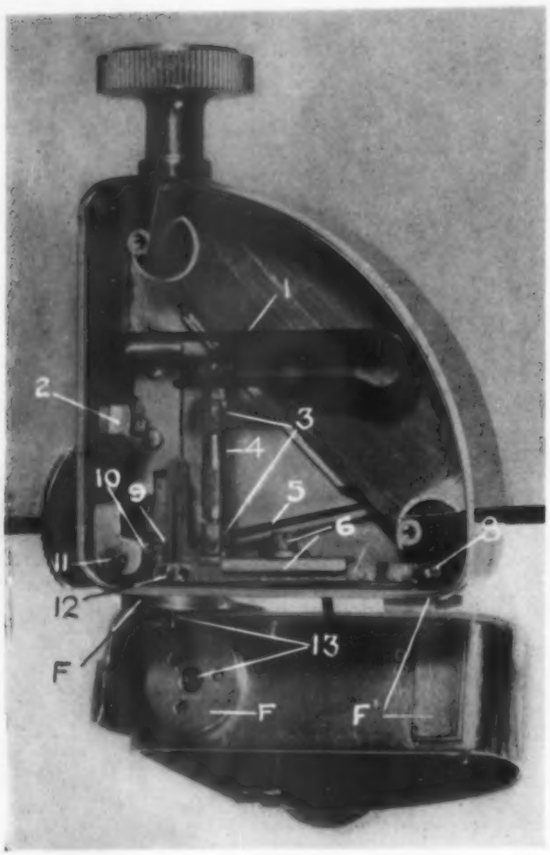



*Fig. 3—The Mechanism of a Durometer*

tional to the two-thirds power of the Load $L$ and inversely proportional to the cube root of the diameter $D$ of the indentor, the proportionality factor containing the elastic moduli. For vulcanized rubber, where Poisson's ratio is ½, Young's modulus $E$ can be determined by the relation:

$$d = (0.86/E^{1/3})\ (L^{1/3}/D^{1/3}) \ldots . (1)$$

2. The normal deflection of the surface of the rubber does not fall off rapidly with distance from the indentor, being 4 per cent of the maximum indentation at a distance from the indentor equal to ten times the radius of contact $a$ ( $= \sqrt{(dD/2)}$ ). Therefore the indentor should be placed several times this distance from a free edge.

3. The compressive stress along the axis of penetration has dropped to 1 per cent of its initial value in a distance equal to ten times the radius of contact. Consequently the thickness of the sample should be this much.

4. The stress system at the center of contact is one of pure hydrostatic pressure.

5. The normal compressive stress, $p$, in the contact area at a distance, $r$, from the center is

$$p = 3L\ (a^2 - r^2)^{1/2}/2\ \pi\ a^3 \ldots . (2)$$

where $a$ is the radius of contact area. This is a maximum at the center and vanishes at the edge of contact.

(5) Symposium on Rubber, p. 96, Cleveland Regional Meeting, Am. Soc. Testing Mats. (1932). (Available as a separate publication.)

The problem of penetration by a rigid cylinder was worked out early in the development of Elasticity Theory. If a rigid right cylinder is pressed into a plane surface, the indentation is proportional to the first power of the load and inversely proportional to the first power of the diameter, the proportionality factor containing the elastic moduli. The normal compressive stress on the face of the cylinder

$$p = L/2\ \pi\ a\ (a^2 - r^2)^{1/2} \ldots . (3)$$

becomes infinite at the edge instead of dropping to zero as it does with the spherical indentor.

## Standardization of Shore Durometers, Type A

Shore has stated *(5)* that his specifications are as follows: "This instrument, in the absence of other specific demands made upon it with respect to calibration of the dial, has been originally provided with a simple metric scale. It has a frustum cone impresser pin 3/64 in. in diameter, with the flat tip 1/32 in. The pin begins to yield and the indicator hand departs from zero after a pre-pressure of 2 oz., then proceeding up to 29 oz. at which point 100 is indicated on the dial. The total stroke of the pin is 0.1 in. so that each division on the dial would stand for 0.001 in. of depth travel, which while not regularly shown would read inversely, that is, the zero for the depth travel would be at 100 on the scale, and 100 depth would be at zero of the adopted scale."

The durometer is shown in Fig. 3. As the indentor *13* is pushed into the case, rotating about *8* with respect to the case, the rack *9* turns the pinion *10* and carries the pointer *5* over the scale (not shown). Consequently the scale measures directly only the motion of the pin with respect to the case. This motion is resisted by the flexing of spring *1* but the reaction of

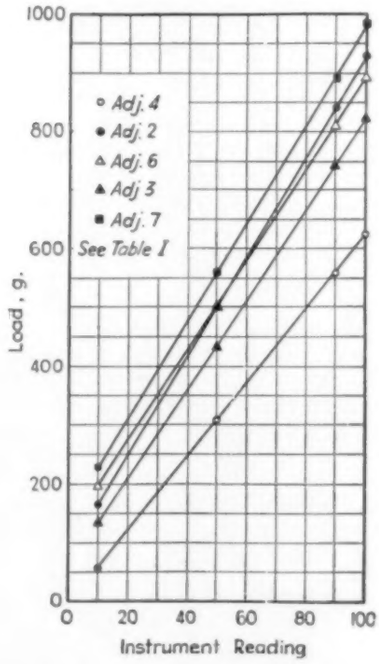



*Fig. 4—Typical Load-Scale Reading Curves*

the spring through linkage *4* is not in the direction of motion of the impresser pin. Since the radius of the arc of rotation of the lower end of the linkage can be varied considerably by moving slide *6*, the load-deflection curve of the instrument is not necessarily a straight line. The "stress-strain" curve of the upper bearing *3* is determined by the geometry of spring *1* and by the material of the spring but the region of this curve over which deflections of the pointer take place is determined by the length of linkage *4*, once the nut *2* has been securely locked.

As the instrument is pressed against a rubber surface by the knurled thumbrest at the top, the pressure of application is transferred to the rubber through the pin. In order that no lateral forces be applied to the pin, the rest plates *F, F' must* be parallel to the surface at all times. If the pressure is greater than that just necessary to define the plane of reference the rubber will rise in the hole in *F*, carrying the indentor up with it to a falsely high hardness figure.

We see there are three adjustments—position of slide *6*, length of linkage *4*, and length of pin *13*—which may be made to change the hardness reading of a durometer on a given sample. How does each of these adjustments influence the reading and the load-deflection relation? This question was answered by manipulation of a single durometer. The effect of the first two adjustments was studied by moving slide *6* to the left and to the right of normal and by rotating the collar clockwise and counterclockwise, separately and in combination. Nine settings were thus made. These adjustments gave the variations in hardnesses on four samples shown in Table I. It can be seen that large changes in hardness values of sample No. 1 were produced, but no significant change in value for sample No. 4. Because of the coarseness of the screw in the turnbuckle linkage and the roughness of the trunion arm, it is difficult to make these adjustments precisely.

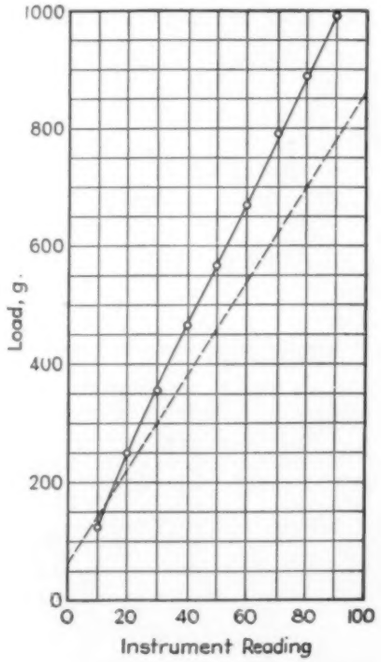



*Fig. 5—A Non-Linear Load-Scale Reading Curve*

TABLE I.—VARIATION IN READINGS OF TYPE A DUROMETER WITH ADJUSTMENTS OF COLLAR AND SLIDE.

| *Adjustment* | Sample No. 1 | Sample No. 2 | Sample No. 3 | Sample No. 4 |
|---|---|---|---|---|
| 1. Durometer adjusted to normal conditions | 22 | 34 | 70 | 97 |
| 2. Slide moved 0.02 in. to left of normal | 21 | 32 | 68 | 96 |
| 3. Slide moved 0.02 in. to right of normal | 24 | 36 | 70 | 96 |
| 4. Slide moved 0.08 in. to right of normal | 33 | 45 | 75 | 97 |
| 5. Slide as in 4, collar turned two faces to right | 28 | 41 | 75 | 96 |
| 6. Collar as in 5, slide returned to normal position | 19 | 31 | 69 | 96 |
| 7. Collar as in 6, slide moved 0.02 in. to left of normal | 15 | 28 | 66 | 95 |
| 8. Slide as in 7, collar turned two faces to left | 25 | 36 | 71 | 97 |
| 9. Durometer returned approximately to normal adjustments | 22 | 34 | 70 | 96 |

While making these two adjustments the loads at four scale points were measured, Fig. 4. Since the curves are all of the type $y = mx + b$, it can be seen that by these two adjustments the load-deflection curve of a durometer may be moved parallel to itself (change in $b$) or rotated (change in $m$) or, generally, may be given both translation and rotation. Figure 5 shows a non-linear load-deflection curve obtained when the slide adjustment was set far toward the left, as it has been found in durometers received for calibration.

In considering the third adjustment, it should be noted that the length of pin protruding can have no effect whatever on the load-deflection curve, though it does change the hardness reading obtained with any given sample of rubber. If $d$ is the penetration into the rubber (length protruding), in inches, and $S$ the corresponding scale reading it follows, from the geometry of the rack-and-pinion mechanism, that, neglecting the small departure from the straight-line motion of the pin,

$$d = K\ (S_a - S) = mK\ (L_a - L) \ldots . (4)$$

where:

$K$ = a constant defined by the geometry of the mechanism,

$S_a$ = the scale reading when the base of the pin is flush with the surface of the rest-plate,

$m$ = the slope of the load-deflection line, and

$L_a$ and $L$ = the corresponding loads.

If the instrument were of the dead-load type the penetration from the reference plane (infinite hardness) would be independent of the length of indentor. In this durometer, however, the applied load is nearly proportional to the movement of the indentor from its position at zero hardness, and the length of scale between zero and infinite hardness depends on the protruding length of indentor.

In order to determine the magnitude of the effect, a particular instrument was adjusted by changing the protruding length of indentor to read, successively, 95.5, 100, 105 when pressed against a flat piece of

plate glass. The hardness values of a series of rubber blocks were observed for each value of $S_a$ and the penetration calculated by Eq. 4, with the results shown in Fig. 6. These data show that the hardness reading on any sample depends on the length of pin, and the variation in hardness readings from this cause is greatest at the upper end of the scale. Therefore, this length must be specified with close tolerances.

The specifications quoted at the beginning of this section are not clear and there is no mention of tolerances. It must be inferred that a linear load-deflection curve is assumed by the manufacturer in order that the two loads given shall uniquely determine the relation. That few durometers in use comply with these simple specifications on load is shown by the data in Fig. 7. Not one of these five instruments complied with the load specifications, all five having lower than specified "pre-pressures" and three of the five having lower than normal 100-division loads.

Furthermore, the durometers met with in use do not conform to specifications in the other two respects in which specifications are given, as can be seen from Table II. It is true that the variations in length of pin given in the table are not large, *per se*, but, as the data in Fig. 6 show, a slight change in length may make a large change in hardness value, especially at the upper end of the scale. The diameters of base of indentors have been found to vary over a wide range, from 3 per cent below, to 11 per cent above, the specified value. Since the penetration is theoretically inversely proportional to diameter, there would be a wide variation in hardness readings among these five instruments, even when all are set to the same loads.

As a result of the foregoing study of durometer action the following procedure for standardization was adopted by the B. F. Goodrich Co. in November, 1936:

1. The instrument is put into good mechanical condition, that is, cleaned, bearings set properly to minimize friction, pointer adjusted, parallax eliminated, and back-lash in the rack and pinion reduced as far as feasible.

2. The base of the pin is examined under a micrometer microscope. If not flat and circular the pin is either replaced or ground.

3. The load-deflection curve is adjusted to a straight line; the pre-pressure is taken as 57 g. (2 oz.) and the 100 division load as 822 g. (29 oz.) on a 0.0312 ± 0.003-in. diameter indentor. If the diameter of the base is larger, or smaller, than 0.0312 in. the loads are changed in direct proportion. A tolerance of not more than 5 g. is permitted on the load at any point.

4. The length of pin protruding from the rest plate is adjusted until, when the durometer is pressed against a flat plate glass surface, the pointer covers the 100-division mark on the scale.

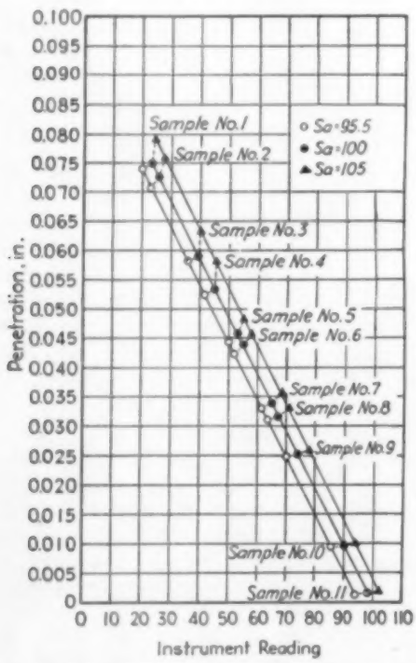



*Fig. 6—The Effect of Length of Indentor on Hardness Readings and Penetrations*

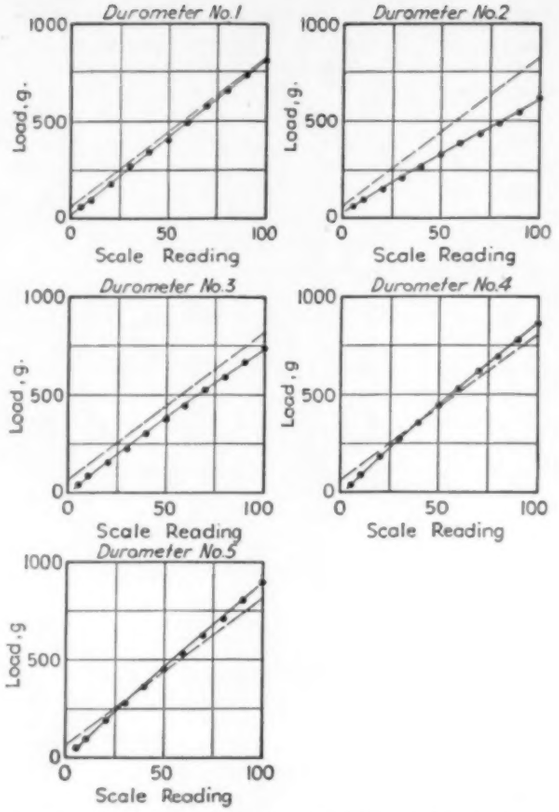



*Fig. 7—Load-Scale Reading Curves of Durometers*

TABLE II.—OBSERVED LENGTHS OF PIN AND BASE DIAMETERS OF INDENTORS OF FIVE TYPE A DUROMETERS.

| *Instrument* | *Length, in.* | *Deviation from Specification per cent* | *Diameter, in.* | *Deviation from Specification per cent* |
|---|---|---|---|---|
| Specification ... | 0.09375 | .... | 0.03125 | .... |
| No. 1 ..... | 0.0951 | +1.4 | 0.0347 | +11 |
| No. 2 ..... | 0.0933 | —1.5 | 0.0341 | + 9 |
| No. 3 ..... | 0.0939 | +0.2 | 0.0326 | + 4 |
| No. 4 ..... | 0.0939 | +0.2 | * | .... |
| No. 5 ..... | 0.1010 | +7.7 | 0.0304 | — 3 |

* Badly rounded at edge.

TABLE III.—ANALYSIS OF TWENTY REPRESENTATIVE TYPE A DUROMETERS

| | *Diameter of Face, in.* | *Hardness* Sample No. 1 Before | After | Sample No. 2 Before | After | Sample No. 3 Before | After | Sample No. 4 Before | After | *Condition of Face of Indentor* |
|---|---|---|---|---|---|---|---|---|---|---|
| No. 1 ..... | 0.0320 | 22 | 22 | 37 | 35 | 74 | 70 | 96 | 96 | Flat, small nicks, edge rounded slightly. |
| No. 2 ..... | 0.0311 | 25 | 23 | 37 | 35 | 72 | 70 | 98 | 96 | Flat, edge rounded slightly. |
| No. 3 ..... | 0.0271 | 29 | 23 | 39 | 35 | 71 | 70 | 96 | 97 | Flat, edge rounded slightly. |
| No. 4 ..... | 0.0304 | 28 | 23 | 39 | 35 | 73 | 70 | 100 | 96 | Flat, edge sharp. |
| No. 5 ..... | 0.0289 | 25 | 22 | 35 | 35 | 64 | 70 | 80 | 96 | Flat, edge rounded slightly. |
| No. 6 ..... | 0.0303 | 23 | 22 | 36 | 35 | 70 | 70 | 97 | 96 | Flat, edge sharp. |
| No. 7 ..... | 0.0314 | 23 | 22 | 34 | 35 | 72 | 70 | 100 | 96 | Flat, edge sharp. |
| No. 8 ..... | 0.0313 | 24 | 22 | 34 | 35 | 70 | 70 | 97 | 96 | Flat, edge rounded slightly. |
| No. 9 ..... | 0.0305 | 26 | 21 | 37 | 34 | 71 | 70 | 97 | 96 | Flat, edge sharp. |
| No. 10 ..... | 0.0322 | 24 | 22 | 37 | 34 | 73 | 70 | 101 | 97 | Flat, edge sharp. |
| No. 11 ..... | 0.0296 | 28 | 22 | 39 | 35 | 73 | 70 | 98 | 96 | Out of round, edge rounded. |
| No. 12 ..... | 0.0306 | 27 | 21 | 42 | 34 | 76 | 70 | 99 | 96 | Edge turned over in places. |
| No. 13 ..... | 0.0323 | 28 | 22 | 38 | 35 | 72 | 70 | 98 | 96 | Edge rounded, surface pitted. |
| No. 14 ..... | 0.0303 | 25 | 22 | 36 | 35 | 70 | 70 | 99 | 96 | Edge rounded considerably. |
| No. 15 ..... | ..... | 31 | 22 | 42 | 35 | 74 | 70 | 95 | 96 | Diameter greater than specification, edge rounded. |
| No. 16 ..... | 0.0341 | 24 | 23 | 37 | 35 | 74 | 70 | 99 | 96 | Diameter greater than specification, edge rounded. |
| No. 17 ..... | 0.0349 | 23 | 22 | 33 | 35 | 70 | 70 | 98 | 96 | Diameter greater than specification, edge rounded. |
| No. 18 ..... | 0.0334 | 25 | 22 | 36 | 35 | 72 | 70 | 98 | 96 | Diameter greater than specification, surface rough. |
| No. 19 ..... | 0.0280 | 25 | 22 | 39 | 35 | 75 | 70 | 98 | 96 | Surface rough and pitted, edge broken. |
| No. 20 ..... | 0.0292 | 18 | 22 | 29 | 34 | 61 | 70 | 84 | 96 | Surface rough, out of round. |

5. The final check on adjustments 3 and 4 is made with the back of the case closed tightly by means of both screws.

6. During readings, the durometer is held with the rest plates $F$ and $F'$ parallel to the surface of the sample and pressed slowly against the sample with just sufficient force to insure contact. The initial deflection is taken as the reading.

It will be noticed that the departures from manufacturer's standards are few, but that compliance with tolerances is rigorous.

These standards have been in use at the B. F. Goodrich Co. for over three years, with approximately 70 durometers kept under control. Each durometer is returned regularly for routine inspection at least once a year. If, for any reason, the reliability of a durometer becomes questionable, it is immediately sent in for adjustment. Thus, over a period of several years, data have been acquired on the performance of the program.

The analysis of the first 20 durometers which were adjusted is illustrative of the value of this work. It will be noticed (Table III) that the data are divided into two groups. The ten durometers listed above the dividing rule in the table were *standardized* according to the procedure given above, those below the rule in the table were *calibrated* by comparison with standardized durometers because of the reasons given in the last column. These durometers could have been standardized if facilities were available for grinding the indentors but this was found unnecessary.

The hardnesses given in Table III were obtained by the author. Since the factor of personal prejudice cannot be completely eliminated by any one person, these data do not constitute reliable proof that the standardizing technique is successful. Proof which is independent of the personal factor is presented in Table IV. These data were compiled by Ivan Gazdik, of this laboratory, by collecting readings from six technical men for several compounds tested with their own durometers—which were standardized by the above method. Only two of the six have had any instruction in the author's technique of reading the durometer and only one knew that any comparison was being made.

## General Principles of Hardness Tester Design

Several conclusions can be drawn from this work concerning the design of an ideal hardness tester. Obviously the manufacturer must maintain definite and close tolerances on every variable (including friction) in order that his instruments shall be reproducible among themselves.

The readings given by an ideal tester measure a fundamental physical property of the sample, either the elastic modulus or a related quantity. A portable tester can do this most readily by indicating the force required to produce a specified small indent. The nonportable laboratory instrument can be equipped with several weights and a range of indentor sizes for the measurement of a wide range of hardnesses.

The ideal indentor itself is spherical (ball tipped) rather than cylindrical or "conical." The flat-faced indentor produces infinite compressive stress at the edge of contact (Eq. 3), causing abnormal wear at

TABLE IV.—PERSONAL VARIATIONS IN STANDARDIZED DUROMETERS.

| *Sample* | *Hardness Read by Observer* L | Ga | K | F | S | G |
|---|---|---|---|---|---|---|
| A ..... | 36 | 37 | 36 | 37 to 38 | 37 to 38 | 36 |
| B ..... | 33 | 34 to 35 | 35 | 34 to 35 | 35 to 36 | 33 |
| C ..... | 38 | 38 | 39 | 40 | 40 | 37 |
| D ..... | 41 | 41 | 41 | 41 | 41 | 40 |
| E ..... | 55 | 55 | 54 | 53 | 55 | 53 |
| F ..... | 38 to 39 | 41 | 41 | .... | .... | 40 |
| G ..... | 58 | 58 to 60 | 57 | .... | .... | 57 |
| H ..... | 45 | 45 | 45 | .... | 45 | 45 |

the edge of the indentor, and making the reading sensitive to surface friction. The spherical indentor, on the other hand, receives little wear because the compressive stress drops to zero at the edge of contact. Also, the indentation varies with the cube root of the sphere diameter, rather than with the first power of the cylinder diameter, making the hardness readings with a spherical indentor less sensitive to slight variations from the specified diameter.

The penetration produced by the tester can be any convenient value up to 10 to 15 per cent of the diameter of the spherical indentor. Since existing hardness testers employ a wide range of penetrations, up to 300 per cent of the diameter of indentor, a sample whose true hardness lies at one end of such a scale is being examined at high penetration, but a hardness at the other end of the scale is observed under very low indentation. This is one of the reasons why the relation between "durometer hardness" and "shear modulus" is subject to so much controversy in discussions about rubber mountings.

The sample whose hardness is being measured must be thick enough to eliminate the effect of the supporting surface, the minimum thickness being about 10 $\sqrt{dD/2}$. With testers now available it is possible to reverse the order of hardness of two samples as given by different durometers if the softer sample is considerably thinner than the other.

The ideal hardness tester has within itself means for establishing a reference plane of penetration. In the deadweight instrument the zero plane can be approximated very closely by the application of a load which is negligible compared to the load under which the penetration is measured. Since the suggested portable tester measures force at a fixed penetration, the reference plane is determined by a flat annular plate on the bottom of the case, around the indentor. This plate must not in any sense be a "pressure foot." Pressure applied to the rubber over an annular ring forces the rubber up into the hole, producing a false reference plane. In addition, rubber under compression is harder than normal. Consequently, the portable durometer is pressed against the sample with just sufficient force to insure contact between surface and reference plane.

It should be realized that the ideal hardness tester considered here will give reproducible readings on a perfectly elastic material. However, if the sample shows any elastic after-effect, such as is present in rubber, the actual hardness will depend on the rate of application of load, just as it depends on the temperature, and degree of stretch, of the sample. All of these factors must be fixed to attain agreement on even empirical "hardness" measurements throughout the industry.

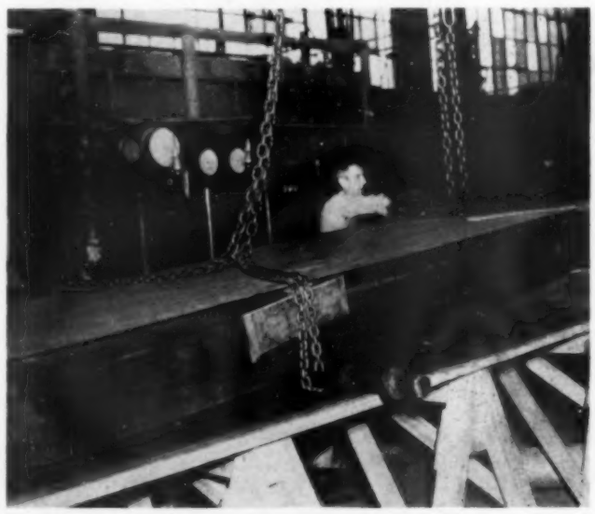
## Rubber Dies for Metal Stamping

THE largest piece of rubber ever designed for commercial application by the Goodyear Tire & Rubber Co., Akron, is making an important contribution to the constantly increasing pace of civil and military aircraft production. Weighing approximately 4,000 pounds—and measuring 160 inches in length, 57 inches in width and 11 inches in thickness—rubber slabs have been installed in huge oil-hydraulic, rapid-acting presses at the plant of the Douglas Aircraft Co., Inc., Santa Monica, California, for blanking and forming millions of aircraft parts made from sheet metal. Originally developed by Douglas, the process is now employed under license by a number of manufacturers.

In ordinary stamping operations of this type, flat metal is stamped into shape by setting a concave or "female" die in the base of a toggle or hydraulic press, and a convex or "male" die in the ram of the press, sliding the flat metal between both dies and then bringing the ram of the press down hard under tremendous pressure. In the new method, rubber is confined within a steel container which descends slowly upon a lower press table where many types of dies may be operated simultaneously. When pressure is applied the rubber conforms to the shape of the dies, thus forming and blanking sheets into their desired shapes. In three presses operated by Douglas, blanking and forming operations are contemporaneous.

The new method creates a simple but effective procedure for fabrication of sheet metal parts. Distinct production economies and advantages result from this new application, which, like similar ones, is made possible by the fact that rubber is incompressible, but can be altered in shape without variation in volume. Employing a rubber slab, only one half of the usual pair of dies is required, due to the rubber conforming to the opposite shape of any object when under pressure. This, and the fact that the dies may be made from wood substitutes, or from soft metals, instead of the customary tool steel, cuts costs to a fraction of former methods.

Parts pressed out by the new rubber slab process have no scratches or burrs on the side brought in contact with the slab, thus eliminating the necessity for burnishing or buffing operations in most cases. In those cases where a specific type of burled or other decorative surface is desired on one side of the finished product, the design may be impressed on the surface prior to the forming and flanging, and will not be damaged during these operations by the rubber slab.



*Rubber slab used for blanking operations.*

# RUBBER—
# A Strategic Raw Material

**BY P. W. BARKER**

*Business Specialist,*
*Rubber and Rubber Manufacturers Section*
*Bureau of Foreign & Domestic Commerce*

*National defense preparations continue to occupy the nation's legislators at Washington, as well as industry in general. The fact that rubber is one of the strategic materials upon which the United States must depend on foreign sources of supply has been strongly stressed in recent months. The initial report of the Materials Procurement Division of the National Defense Advisory Commission revealed that rubber was the first material given consideration by the Commission. The accompanying article, therefore, taken from the first issue of "Domestic Commerce Weekly," a new periodical of the Bureau of Foreign and Domestic Commerce, which replaces "Domestic Commerce," which not only reviews rubber's position as a strategic material but puts forth a plan for accomplishing America's independence from foreign sources, should prove of specific interest.*

MODERN military operations require millions of men and tremendous supplies of strategic materials, one of the most important of which is rubber. Every military plan considers the availability of rubber along with iron, clothing, foodstuffs, and other essential materials, for, without rubber, automobiles and tanks would lose their mobility, airplanes could not successfully leave the ground and return, and the machinery of naval vessels could not attain maximum efficiency. Rubber enters our everyday lives to such an extent that few give thought to its sources or history. It is accepted as being one of the necessities of modern civilization. Large quantities of rubber are used annually in the United States—about 1,350,000,000 pounds at the present time—and our yearly requirement for rubber has made it the item of greatest value imported by this country during the last 5 years, averaging more than $151,000,000 per annum and exceeding the cost of such important foreign-produced commodities as cane sugar, coffee, wood pulp, and raw silk. About 500 American establishments are engaged in the manufacture of rubber products, and the industry gives employment directly to more than 150,000 persons who manufacture goods valued at over $1,000,000,000 annually at retail.

Rubber is one of the many useful products contributed to civilization through the discovery of America. Spanish and Portuguese historians, writing of the New World, claimed that Columbus on his second voyage of discovery saw the natives playing games with bouncing balls made from the juice of trees, and that Emperor Montezuma in 1520 entertained Cortez and his soldiers in Mexico City with a game played with such balls. Excavations of ruins in Central and South America give scientists reason to believe that rubber was known to the Indians of America as early as the eleventh century A.D., if not before.

Francois Fresneau and Charles Marie de la Condamine, French scientists, first reported the existence of rubber to the French Academy in 1736 and 1751. Another famous name associated with rubber is that of Joseph Priestley, English chemist, the discoverer of oxygen. In the preface to a work published in 1770, Priestley invited attention to "a substance excellently adapted to the purpose of wiping from paper the marks of a black lead pencil." This substance was given the name "rubber" by the English, and its origin was indicated by the adjective "india" or "indian" to denote its origin among the Indians.

Rubber is a coherent, elastic solid obtained from a milky liquid (not to be confused with the sap) which occurs in the bark and in the roots, stem, branches, leaves, and fruit of a wide variety of plants, growing, for the most part, in the Tropics. The rubber of commerce is almost entirely the product of a tree known as *Hevea brasiliensis* which grows wild in the Amazon Valley, but which has been transplanted and cultivated in the Middle East. Although Brazil was the original home of this rubber tree, the countries and islands in southeastern Asia produce practically all of the world's supply of rubber today.

The area producing rubber falls mostly within a belt encircling the earth at the Equator between 10° North and 10° South. In certain parts of this region, temperature and rainfall are favorable, and winds of high velocity destructive to rubber trees are practically unknown. In 1939 approximately 9,000,000 acres of land in this Equatorial region were devoted to rubber plantations—52.9 per cent of the total on British territory (British Malaya, Ceylon, India, Burma, Sarawak, British North Borneo); 39.0 per cent, Netherlands East Indies; 3.7 per cent, French Indochina; 3.0 per cent, Thailand (Siam); and 1.4 per cent, Africa,

Brazil, and Central America. About 53 per cent of the rubber plantation area consists of estates of more than 100 acres each, almost all of European ownership, and the remaining 47 per cent is composed of estates under 100 acres each, largely of native ownership.

Concentration of the rubber-producing industry in the Middle East has facilitated restriction of the output of rubber with a view to increasing its world market price and returning profits to the producers. An early attempt of this nature was made by Brazil in 1910, before the plantation rubber industry had become important, but this attempt was unsuccessful. In 1909 and 1910 (owing partly to the advent of the automobile with its need for rubber tires) rubber prices did reach the high point of about $3 a pound, but the absence of a Brazilian monopoly of the rubber supply and the appearance of large quantities of plantation rubber on the market broke the attempted restrictive measures.

## Second Attempt at Restriction

Another attempt at restriction of rubber was made in British Malaya and Ceylon in the period 1922 to 1928, and prices of rubber, largely through speculation, were driven to more than $1 a pound during 1925. The high prices of this restriction period, called the Stevenson Restriction Scheme, encouraged the planting of immense areas of rubber by the natives in Netherlands East Indies, and when the new plantings began bearing, the areas of British Malaya and Ceylon lost their effective monopoly of the rubber supply and the scheme was abandoned. By reason of the low prices of 1932 and 1933 of less than 3 cents a pound, another restriction scheme was instituted in July, 1934, the International Rubber Regulation Agreement, which embraced areas supplying approximately 95 per cent of the total rubber. This restriction scheme is still effective and has been largely responsible for increasing the price of rubber from 3 cents a pound in 1933 to over 20 cents in 1940.

On plantations, rubber trees are planted about 100 to the acre, and the average annual yield of rubber is about 400 pounds or 150 gallons of liquid latex, the juice obtained by incising the bark of the trees. Higher yields have been obtained from special high-yielding stock. Latex contains about one-third dry rubber and two-thirds water, the latter being separated by the addition of a weak acid solution which causes coagulation, a process somewhat similar to the souring and curdling of milk. Most rubber comes to market in the form of sheets which are prepared on the rubber plantations by machinery, but in recent years liquid rubber latex also is shipped to rubber manufacturers after the addition of a preservative, such as ammonia, to keep the latex from coagulating. It has been the ready availability of supplies of latex which has brought about the increased manufacture of rubber products directly from latex.

Successful rubber manufacture is based on the discovery of vulcanization by which a mixture of rubber and sulfur is heated to a high degree of temperature, the resulting product being vulcanized rubber which is practically impervious to ordinary changes in temperature. Before this discovery in 1839 by Charles Goodyear, of New Haven, Conn., rubber products melted in the heat of summer and cracked with brittleness in cold weather, making them little more than curiosities.

Prior to 1914 the bulk of the world's rubber originated from wild trees growing in the Amazon Valley; from trees and shrubs in Central America and Mexico; and from trees, shrubs, and vines in Africa and southeast Asia. In that year, however, rubber from the eastern plantations which had been begun in 1876 from seeds obtained in Brazil by Sir Henry A. Wickham, an Englishman, amounted to more than one-half the total; and from that time onward the bulk of the world's rubber supply has come from plantations. Today about 97 per cent of the total is plantation-grown, coming to America from a distance of over 10,000 miles. In normal times most of our rubber supply passes through the Suez Canal and across the Atlantic Ocean, but when war involves the Mediterranean area, rubber journeys the longer route around the Cape of Good Hope, or comes across the Pacific Ocean direct to Pacific ports or through the Panama Canal to Atlantic ports.

It is the long ocean voyage of over 10,000 miles to the United States and over 5,000 miles for most European countries that makes supplies of this strategic material of the first consideration for the conduct of war. Without naval power, a country is deprived of supplies of rubber at the outset of war and is faced immediately with the necessity for substitution. Germany half succeeded in manufacturing commercially useful synthetic rubber during the World War, and during the present European conflict it is reported that Germany has almost become independent of natural rubber requirements by substitution of synthetic rubber. In this respect it must be emphasized that the needs of Germany for rubber are about one-sixth those of the United States, which annually consumes one-half of the world's output.

## Other Sources of Natural Rubber

How could the United States find a substitute for rubber in the event of war which cut off supplies from the Middle Eastern countries, the source of 95 per cent of our present supply? Many erroneously think that more complete exploitation of resources in the Western Hemisphere would be the answer. The greatest amount of rubber ever produced in any year by any of the territories in the Western Hemisphere was 65,000 tons (40,000 Amazon Valley in 1912, 10,000 guayule from Mexico in 1910, and 15,000 tons in 1910 from other Americas). This amount of rubber was produced at extremely high prices of well over a dollar a pound and it is believed that a wartime need by the United States could not produce more—perhaps not half as much. Another consideration is the need for rubber by the rubber-manufacturing industries in South America which would divert part of the production. Even 65,000 tons of natural rubber from the Western Hemisphere would be only 11 per cent of the total requirements of the United States; current peacetime needs being 600,000 tons of natural rubber and 180,000 tons of reclaimed rubber a year, there would be the necessity of substituting other products for rubber in the manufacture of war materials.

Another long-term consideration would be the cultivation of rubber in the Western Hemisphere and possibly the United States. Congress has appropriated $500,000 to the Department of Agriculture to study and encourage rubber production in South and Central America. Several American experimental ven-

*Increased production of guayule rubber in Mexico and planting and cultivation of this shrub in the United States is part of the author's plan to assure the United States freedom from foreign sources of supply. The illustration on the right is of a "Caterpillar" tractor harvesting guayule on the Continental Rubber plantation in Salinas, Cal.*

tures to cultivate rubber in this territory have met with indifferent success owing to attacks of leaf disease and to the absence of an adequate and trained labor force. These problems, however, are not believed to be impossible of solution, according to experts who have witnessed such experiments. Rubber trees mature in 5 years, and guayule shrubs mature in from 3 to 5 years. Guayule probably could be grown successfully in the United States. The shrub is native to certain areas in our Southwest, and rubber has been produced from guayule in California. The time element, however, would make consideration of other possible sources of the utmost importance.

The use of reclaimed rubber, manufactured from discarded tires and other rubber products, and the conservation of the small amount of natural rubber available at the outbreak of a war, would serve to keep our manufacturing industry in operation at a curtailed rate for the first year or perhaps the second year of the war. But then would come the acute need for natural rubber or a good substitute.

The only immediate answer is synthetic rubber, and that this product would solve the problem of our wartime rubber supply is the belief of the National Defense Advisory Commission, according to a recent press release to the effect that, given a reasonable time, domestic manufacturers of synthetic rubber have the potential ability to free the United States of the need of importing natural rubber. About 2,000 tons of synthetic rubbers were produced in this country during 1939, and less than 10,000 tons will be produced in 1940 even if the Defense Commission lends the influence of the Government to the financial and technical problems of production now confronting the industry.

With our peacetime annual needs for new natural rubber reaching almost the 600,000-ton figure, it is apparent that great development must be made in the domestic manufacture of synthetic rubbers before this country can become entirely free of the need of importing crude rubber.

The United States Government has recognized for some time the grave needs of the country for this strategic raw material. By the terms of an Anglo-American exchange agreement, the United States has agreed to exchange cotton for 86,000 tons of rubber, which is to be held for actual emergency requirements. Through the establishment of a private corporation by the Reconstruction Finance Corporation and the provision of large loans, the Government and rubber manufacturers have effected two agreements with the International Rubber Regulation Committee to purchase additional quantities of 150,000 tons of rubber during 1940 and 180,000 tons in 1941 as a wartime measure. At the end of July, 1940, 34,000 tons of rubber had been received and warehoused in the United States under the cotton-rubber agreement, but purchases have not been appreciable on the projects involving 150,000 and 180,000 tons. By the terms of a Presidential proclamation of July 2, crude rubber, reclaimed rubber, and scrap rubber may be exported from the United States, after July 5, 1940, only upon license obtained from the Department of State, a national defense measure.

It appears that early in 1941 the vigorous efforts now being made for the preparedness and national defense of the United States will be successful so far as supplies of rubber are concerned. Freedom from an absolute dependence upon control over rubber heretofore exercised by plantations more than 10,000 miles from the United States will be achieved by: (1) a supply or stock pile of the best grades of plantation rubber warehoused in this country and held for use only in a national emergency; (2) encouragement of production of synthetic rubbers in the United States; (3) increased production of reclaimed rubber in the United States from rubber scrap, and possibly by (4) increased production of guayule rubber in Mexico; (5) exploitation of Western Hemisphere rubber sources; and (6) planting and cultivation of guayule rubber in the United States. As a final resort, a conservation campaign could be inaugurated to save use of tires and tubes, about three-fourths of our rubber being consumed in these products.

# Editorials . . . . . .

## Stabilizing Rubber Prices

THE announcement by Jesse H. Jones, Federal Loan Administrator, on August 17, to the effect that the recently-organized Rubber Reserve Company, the function of which is to purchase and store crude rubber for use in emergency only, had entered a new agreement with the International Rubber Regulation Committee calling for the purchase of approximately 180,000 tons of rubber during 1941 was welcomed not only by those engaged in preparations for the national defense but by the rubber industry at large as well. Aside from assuring this country of an emergency supply of rubber, the pacts between the Rubber Reserve Company and the Regulation Committee will do much toward stabilizing the price of rubber.

Under the terms of the first pact between the two organizations named above, which called for the purchase of approximately 150,000 tons during 1940, there is a stipulation which provides that the United States shall pay only 18 to 20 cents a pound, with all purchases to be made on the open market. The new pact provides for a price between 17 and 18½ cents a pound, f.o.b. transoceanic shipping points. In other words, under the second pact the New York price in some cases will be slightly higher than that provided in the first pact. In any case, the purchasing policy dictated in the pacts will stabilize the price of rubber within the range set in both agreements.

There is, however, one danger point, i.e., What will happen to the price of rubber in the event of peace between Germany and England? Whether the cushion of United States reserve purchases would be effective in such an event is highly conjectural. Due to war conditions shipping and insurance costs are high. Under the terms of the agreements between the Rubber Reserve Company and the Regulation Committee it would appear that the former would have to keep on paying a price between the limits set even if lower shipping and insurance costs, under peace-time conditions, would warrant a price reduction. The texts of the agreements do not contain any clause dealing with this eventuality. It might be a good idea for all concerned if the Government made itself clear on this point.

## Surveys in Latin America

CONGRESS recently appropriated $500,000 to cover the expenses of surveys to be conducted under the auspices of the Department of Agriculture to determine the best possible locations for rubber cultivation in South and Central America. As most members of the rubber industry will recall, similar survey parties were sent from this country to the same countries back in 1923 and 1924, indirectly as a result of the initiation and operation of the Stevenson Restriction Scheme. The excellent reports of these earlier survey parties are to be found in the "Crude Rubber Survey," a massive book consisting of a number of separate Trade Information Bulletins, that devoted to "Rubber Production of the Amazon Valley" alone occupying 369 pages.

In view of the availability of these reports—and certainly conditions affecting rubber cultivation have not changed radically in the countries concerned in the past sixteen years—the need for the present survey activities might seem surprising, until one learns more of the actual intention and purpose of the new surveyors. It seems that at least two parties will go to already favored points in South America, where soil, climate, and rainfall are suitable for the cultivation of rubber, and there they will not only make a new survey but will encourage the natives to plant and cultivate rubber, providing proved, high-yielding stock for this purpose.

In addition, it is understood that another feature of the work of the Department of Agriculture will be the initiation and carrying out of breeding and cross-pollination experiments. As is well known, the South American leaf disease is very harmful to cultivated stands of rubber in Latin America. The Department of Agriculture has been conducting some cross-pollination experiments in Central America with a view to obtaining a strain resistant or free from the leaf disease. It is not known how successful the experiments have been to date, but on more than one occasion botanists of the Department have stated their confidence in the eventual control or elimination of the disastrous disease. In the light of these revelations, the scientists being sent to Latin America must be considered far more than mere "survey" parties.

# CURRENT NEWS OF THE MONTH

## THOMAS ASSUMES NEW DUTIES AS PRESIDENT OF GOODYEAR

As noted in a brief last-minute paragraph in the preceding issue, Paul W. Litchfield, in a reorganization of the management of the Goodyear Tire & Rubber Co., divested himself of the title of president of that company, as of September 1, but retained the chairmanship of the board. Edwin J. Thomas, executive vice-president, advanced to the presidency.

Public announcement of the change was made by Mr. Litchfield in Akron on August 12 before a gathering of the supervision and executive personnel of the company. "It amounts to a division of responsibilities," Mr. Litchfield stated in making his announcement to the Goodyear group. "As chairman of the board I shall continue to be the senior active executive of the company and primarily responsible for policy. The office of president will be concerned with the execution of policy and the two offices will jointly share the selection and direction of personnel."

In making the announcement, Mr. Litchfield paid warm tribute to the qualifications of Mr. Thomas, who is a native son of Akron, born about the time Goodyear was organized and whose training has been closely directed by Mr. Litchfield during many years.

### *Litchfield's History with Company*

In July Mr. Litchfield celebrated the fortieth anniversary of his association with Goodyear and his sixty-fifth birthday. During the years of this association he has directed the purchase and processing of one-eighth of all of the rubber grown in the world. Not long out of Massachusetts Institute of Technology, he joined the young and struggling company as superintendent in 1900. He became vice-president and factory manager in 1915 and succeeded the late George M. Stadelman to the presidency in 1926. He became chairman of the board in 1930.

Mr. Thomas is the eighth to hold the presidency of the company which was organized in 1898 by F. A. and C. W. Seiberling. After a period as secretary to Mr. Litchfield, who was then factory manager, Mr. Thomas became head of the flying squadron and then manager of factory personnel. He was in California from 1928 to 1930 as general superintendent of the Los Angeles Goodyear plant and returned to Akron to become assistant factory manager. In 1933, following the death of William Stephens, he became general superintendent of the Akron factories and in 1935 was sent to Wolverhampton, England, as managing director of Goodyear's subsidiary there. On his return from England in 1936 he was made assistant to the president and in 1938 he was elected executive vice-president.

Edwin J. Thomas

## Offers New Green Pigments

A new series of green pigments, under the name of Utility Greens, are now being offered to the rubber industry by the Utility Color Co., Inc., 377 Frelinghuysen Avenue, Newark, N. J. The pigments were developed by the company and will be handled exclusively by them. Large amounts may be incorporated into rubber compounds, according to the manufacturers, without any processing difficulties and with good dispersion qualities. Utility Greens are said to be entirely inert, to be compatible with all known fillers, to have no effect on acceleration or retardation of cure, and to be non-discoloring in any combination. Laboratory tests are said to indicate that the new pigments are superior in color strength when compared to chromium oxide. They can be blended to produce clean intermediate colors. Utility Greens are recommended by the manufacturer for use in drug sundries, all rubber garden products, footwear, etc.

## CONGRESS PROGRAM COMPLETED BY RUBBER SAFETY SECTION

The Rubber Section of the National Safety Council has completed its program for presentation during the 29th National Safety Congress and Exposition, which will be held on October 7-11 at the Hotel Stevens in Chicago. Two sessions will be held by the Rubber Section, on Monday and Tuesday afternoons, October 7 and 8, while a luncheon will be held on Tuesday. Thursday, October 10, has been designated as Rubber Section Day at the Exposition which will feature safety devices.

At the first session, on Monday afternoon, which will be held in the West Assembly on the third floor of the Stevens, a general report of activities will be given by R. W. Morse (Firestone), General Chairman of the Section, following which A. C. Horrocks (Goodyear) will deliver a paper on "Getting Safety Off the Defensive." Two 30-minute talks on rubber industry equipment will then be presented, the first, "Safety in Original Design," by R. A. North (Farrel-Birmingham), and the second, "Overcoming Existing Equipment Hazards," by E. W. Beck (U. S. Rubber). Discussion on these two papers will be led by D. G. Welch (Hewitt Rubber).

### *Three Papers for Tuesday*

Three papers are scheduled for presentation at the Tuesday afternoon session, *i.e.*, "Placement of Accident Responsibility," by Paul Van Cleef (Van Cleef Brothers); "Modernizing Safety Advertising," by Lawrence H. Selz, of the Chicago organization of the same name; and "Dermatitis in the Rubber Industry," by Dr. W. E. Obetz, Medical Investigator, Division of Safety & Hygiene, Industrial Commission of Ohio. Discussions at this session will be led by William H. MacKay (Dunlop) and Dr. J. Newton Shirley (Arrow Mutual Liability).

J. T. Kidney (Goodyear) will act as toastmaster at the Tuesday luncheon. During the luncheon election of officers for the 1940-41 season will take place and presentation of safety awards to winners in the last annual contest will be made. Outstanding facts of the Safety Contest for 1939-40 will be given by G. E. Teal, safety supervisor, Naugatuck, Conn., plant, U. S. Rubber Co., who is chairman of the Statistics and Contest Committee of the Council's Rubber Section. "Something different" is also promised during the luncheon.

## GOODYEAR INTRODUCES FABRIC FEATURING VARIETY OF USES

A new fabric which features innumerable uses, waterproofed with a coating of a synthetic substitute for rubber, which is said to have all of the natural product's advantages and none of its disadvantages, has been introduced by the Goodyear Tire & Rubber Co., Akron. Pliosheen is the name given to the new fabric, called the result of the research conducted by Goodyear in recent years on synthetic rubber compounds.

Pliosheen fabrics, either of silk or rayon, are waterproof, odorless, tasteless, flame-resistant, and contain no rubber or oil. The fabrics may be produced in the complete range of delicate pastel colors, deep tones, or clear white, all of which are sun-resistant and proof against cracking or peeling.

Lightweight Pliosheen fabrics are sheer and soft, but extremely strong and durable. They combine high soil-resistance with a facility for easy cleaning, a damp cloth being adequate for removal of most common stains. Pliosheen fabrics may be printed without technical difficulties, making possible an unlimited array of patterns designed to harmonize or contrast with surroundings of any specific application.

Announcement of Pliosheen to the public has been withheld for more than a year during which time exhaustive and widespread field tests have been conducted, which prove the adaptability of the material to use as raincoats, shower curtains, drapes, umbrellas, hospital sheeting, oxygen tents, infants' wear and similar applications.

The development of Pliosheen is exemplary of benefits being derived from the research of organic chemists with common natural resources in their quest for rubber substitutes. The new fabrics are produced through treatment with a combination of ingredients extracted from limestone, coal and salt, all three of which are available in practically unlimited quantities within the continental boundaries of the United States.

Arrangement for the distribution of Pliosheen has been made by Goodyear with Harte & Company, of New York, pioneers in the production of specially-processed fabrics, who in turn will supply a number of prominent manufacturers in various industries to convert Pliosheen into finished products. Pliosheen articles will be marketed through leading stores on a national basis.

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A war export duty of 5% *ad valorem* was levied against the shipment of crude rubber and other products by the Netherlands East Indies last month. The new duty is in addition to already existing duties and taxes on various commodities. However, the new duty was described as a war measure and indications were given that it would not be a permanent measure.

## Coming Events

**Oct. 1.** Los Angeles Rubber Group, Hotel Mayflower, Los Angeles.

**Oct. 7-11.** National Safety Congress, Stevens Hotel, Chicago, Ill.

**Oct. 12-20.** National Automobile Show, Grand Central Palace, N. Y.

**Oct. 27-29.** Nat'l Ass'n of Waste Material Dealers, Fall Convention, Hollenden Hotel, Cleveland.

**Dec. 2-5.** American Society of Mechanical Engineers, Annual Meeting, Hotel Astor, New York.

**Jan. 6-10.** S.A.E. Annual Meeting, Book-Cadillac Hotel, Detroit, Mich.

**June 23-27.** A.S.T.M. Annual Meeting, Palmer House, Chicago, Ill.

### Purchase Pocono Company

The National Automotive Fibre Corporation, Detroit, Mich., has purchased the complete assets of the Pocono Co., Trenton, N. J. The plant will become the seventh operated by the fibre concern. Victor S. Pollak, president of Pocono, will continue with the new owners as manager of the Trenton plant. All other officers will continue to serve at least until Pocono is completely liquidated as a going concern. Pocono formerly supplied National Automotive Fibre wtih sponge rubber mats for use in automobiles, in addition to manufacturing various types of rubberized fabrics. In the future, however, it is understood the plant will produce mats only.

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### Interstate Welding Moves

Interstate Welding Service, which offers a complete Banbury Mixer rebuilding service to rubber manufacturers throughout the United States and Canada, has moved into new and larger factory quarters at 914 Miami Street, Akron, Ohio. With its increased facilities, the company is equipped for speedy rebuilding work and has its own machine shop with modern equipment capable of handling Banbury rotors up to and including the largest No. 27 size, according to company officials.

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### Rubber from Tomatoes

According to reports from Italy, Dr. Mauri, of Parma, has perfected a process by which it is possible to manufacture high grade synthetic rubber from tomato skins. It was further reported that a large supply of skins are available from commercial users of tomatoes and that from the 800,000 tons of tomatoes produced annually in Italy some 2,000 tons of rubber could be secured.

## PLANTING ACTIVITIES GROW IN THE WESTERN HEMISPHERE

Plans for the widespread cultivation of crude rubber in the South and Latin American countries continued to be made last month. Brazil and Bolivia, particularly, drew plans to hasten developments, while Dr. T. D. Mallery, botanist of the Carnegie Institute, left for Central America to cooperate with authorities of various countries in making a survey of areas most suitable for rubber cultivation.

The Federal Trade Council and the Colonization and Immigration Council of Brazil announced plans for moving farm laborers from northeast drought regions to the Amazon Valley, including Fordlandia. Full exploitation of the Fordlandia areas is understood to have been retarded because of the lack of labor. There are reported to be 7,500 workers on these plantations now, but the Ford company could use double that number to hasten development. If the announced plans are successful this labor shortage would be solved.

At about the same time the Bolivian Government made known financial plans for assisting American rubber cultivation experts who come to that country, suggesting, however, that they should not arrive before next April because of the rainy season. Experimental stations are believed planned for the northeastern districts of Bolivia. This country once exported her rubber through the Amazon River, and all such rubber became known as Brazilian rubber. The rubber boom in Bolivia lasted until about 1910, when competition from the Far East caused exports to dwindle.

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The Board of Transportation of New York City is experimenting with new types of seats in the city-owned and controlled subway trains. A new type of seat, made of a spongy, plastic material that cannot fray, equipped with an Airtex cushion, is being tried out on one of the cars of the Independent Subway. If the experiment proves successful, all new cars will be equipped with the new seats, while old cars will get them whenever reconditioned.

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A new factory, which will add 140,000 square feet of floor space to the company's present manufacturing facilities, has been purchased in New Bedford, Mass., by the Aushnet Process Co. The company is understood to be doing considerable experimental work with some of the newer synthetic rubbers.

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An efficient, economical container for frozen foods has been announced under the name of "Cry-O-Pak" by the Container Corporation of America, Chicago. The new container is a combination of the "Cry-O-Vac" latex bags, developed by the Dewey & Almy Chemical Co., and a solid fiber or corrugated paperboard case. It may be used for the bulk freezing of liquids, such as fruit juices.

## PRODUCTION FACILITIES FOR CHEMIGUM EXPANDED

Immediate and substantial increase in facilities for the manufacture of Chemigum, the name applied to its so-called synthetic rubber, was announced last month by the Goodyear Tire & Rubber Co. Although it has long been known that Goodyear was experimenting with its own type of synthetic rubber, it was not generally known until the announcement that the new rubber was being called Chemigum.

For the past three years Goodyear has been making Chemigum in a small pilot plant. A semi-commercial plant, with an initial capacity of 10,000 pounds per day, is now being installed at Akron in space which has been made available within the company's existing buildings. Plans are also completed for further large expansion of manufacturing facilities for Chemigum for use in the event of any emergency which might threaten the nation's supply of crude rubber.

### *Chemigum Derived from Petroleum*

Chemigum is derived from petroleum, through a cracking process, and is the culmination of lengthy and extensive work by R. P. Dinsmore, in charge of all development and research, and L. B. Sebrell, manager of chemical research. Under the direction of these two chemists, the laboratory staff collaborated in the development and exploration of more than 300 different compounds before the new synthetic was produced. Numerous patent applications have been filed to cover Chemigum manufacturing processes.

Tires of the newly announced rubber, which Goodyear calls "chemical rubber," give superior performance to those made of German Buna, according to the company, and equal to those made of natural rubber. In the development of the new rubber, the 300 original compounds were narrowed down to 70 which gave fair results. Further research reduced the list to 10 basic compounds, which in turn were later cut down to only four.

Important advantages claimed for Chemigum by Goodyear include increased tensile strength, resistance to aging, abrasion and oils, and the fact that it may be processed more easily than Buna, using in general the same production methods and equipment currently in use with natural rubber. It is also said to be much more resistant to oxidation than natural rubber, and has possibilities for blending with natural rubber, which would serve to extend a limited supply of the latter.

Road and laboratory tests have been conducted with Chemigum tires over a three year period. It is, however, already being used in the manufacture of Goodyear gasoline hose, airplane brakes, gaskets, sealing rings, and many other products where it has demonstrated definite superiority over natural rubber.

"At present Chemigum costs more than natural rubber," said P. W. Litchfield, who recently resigned as president of Goodyear but who retains his chairmanship of the board of directors. "Its use in general commercial manufacture will be quite limited in the near future unless a national crisis should develop."

"However," continued Mr. Litchfield, "in the development of Chemigum, Goodyear has played its part in assuring the nation an adequate supply to meet vital needs in time of emergency. Much remains to be done to complete its development on a large commercial scale. But we know from our success to date that the job can be done—when and if the need arises."

### Reclaiming Research Program

The Midwest Rubber Reclaiming Co., of East St. Louis, Ill., and Barberton, Ohio, has recently concluded an agreement with the Massachusetts Institute of Technology, Cambridge, Mass., for a five-year research program. The program contemplates research in all fields of rubber reclaiming, with emphasis on the reclamation of compounds made from the so-called synthetic rubbers. The research project is under the direct supervision of Dr. Ernst A. Hauser, while the actual work will be under the direction of Dr. D. S. le Beau.

Industrial Equipment Co., dealers in new and used machinery for the rubber, plastic, chemical and other industries, has moved its warehouse and factory to 868 Broad Street in Newark, N. J.

## UNITED STATES TO PURCHASE ADDITIONAL RUBBER TONNAGE

A new agreement has been concluded between the Rubber Reserve Company, recently organized by the United States Government to acquire reserve stock piles of rubber for use in emergency purposes, and the International Rubber Regulation Committee, represented by Sir John Hay, providing for the purchase of an additional reserve stock of rubber up to 180,000 tons during 1941. The new agreement, which provides for a price range basis of 17 to 18½ cents a pound, f.o.b. transoceanic ships at point of shipment, as compared with 18 to 20 cents a pound in the first agreement, was made public by Jesse H. Jones, Federal Loan Administrator, on August 17.

The 180,000 tons called for in the new agreement, with the 85,000 tons acquired through the cotton-for-rubber barter deal between the United States and Great Britain, and the 150,000 tons which the Rubber Reserve Company has heretofore agreed with the Regulation Committee to purchase during the remainder of the current year, will, when all the rubber is received, provide a reserve stock in excess of 400,000 tons.

Additional loans to the Rubber Reserve Company, which is capitalized at $5,000,000, half of which was subscribed by the government and the balance by domestic rubber manufacturers, amounting to $75,000,000 have been authorized by the Reconstruction Finance Corporation to purchase and carry the 180,000 tons provided for in the new agreement.

*Dr. L. B. Sebrell (left) and Dr. R. P. Dinsmore (right), Goodyear research chemists who played a large part in the creation of Chemigum, with a tire made from it.*

## POSSIBILITIES OF CASTILLA ARE POINTED OUT BY E. G. HOLT

The possibility that the Castilla tree might again become an important source of rubber, with a specially developed technique for plantation operations, was recently pointed out by E. G. Holt, Chief, Leather & Rubber Division, Bureau of Foreign & Domestic Commerce, at the VIIIth American Scientific Congress held in Washington, D. C. The following excerpt, taken from Mr. Holt's paper on "Importance of Rubber to the New World," stresses the possibilty:

In 1907-1908 more acreage was planted with rubber in Southern Mexico than in Malaya, but the tree chiefly planted was the Castilla, and successful production methods were not developed. Plantation methods suitable for Hevea cannot be successfully used for Castilla trees.

It has sometimes been suggested that a large Castilla plantation undertaking might be successful if operated as a combined lumbering and rubber project. The idea advanced would involve a very large acreage, planting a certain area each year with Castilla for a period of several years; after a fixed number of years harvesting the first crop of trees planted, extracting all the rubber and converting the wood to lumber or pulp, and replanting the acreage harvested to assure continuity of production.

No attempt to prove practical possibilities of such an undertaking has ever been made, but since such an acreage would constitute a rubber reserve accessible in case of need, and capable of exploitation as market conditions might warrant, it seems that the idea might merit investigation, especially as the Castilla tree is not subject to the South American leaf disease which attacks Hevea.

It has been pointed out that the suggested operations might be facilitated by the development of appropriate specially adapted machinery for separation of rubber, pulp, and any other commercial products of the Castilla tree at time of harvesting.

### Super-Mileage Camelback

Introduction of a new type of Camelback, made of first-quality tire tread stock, has been announced by the B. F. Goodrich Co., Akron. Called Super-Mileage Camelback, the new material is made by a special process. Instead of spraying the entire compound with solvents to obtain adhesion, as in other camelback-making methods, Goodrich has developed a technique which treats only a thin layer of the tread compound. The result is said to be a product in which the penetrating depth of the solvent is controlled, providing a soft, adhesive surface that flows freely into the rasped surface of the retreaded tire, leaving the rest of the compound strong and tough.

### Back Issues Wanted!

The publishers of RUBBER AGE are in need of the following issues to restore depleted stocks: March, August and November, 1939, and March, April and July, 1940. The sum of twenty-five (25c) cents will be paid for each of these issues returned in good condition. All issues should be addressed to Circulation Department, RUBBER AGE, 250 West 57th Street, New York City.

Steps are being taken by the Akron Library Board to move the Public Library into large quarters and turn the present library building into a permanent rubber museum. Under present plans, one of the civic groups, such as the Junior Chamber of Commerce, would sponsor the museum.

Newspapers of St. Louis, Missouri, have accepted a list of standards proposed by the Better Business Bureau of that city as censorship rules to govern the acceptance of tire advertising. The standards, a copy of which may be secured without cost from the Bureau, are somewhat similar to those recently drawn up by the Better Business Bureau of New York.

Construction of an addition to the first unit of the St. Marys Manufacturing Company's plant in St. Marys, Ohio, has been announced. The new unit, which will be completed by September 1, will double the size of the molded rubber goods plant. The company is a Goodyear subsidiary.

Carbon black has been successfully applied to paper-impregnated cable, according to H. Donn Keresey, president, Anaconda Wire & Cable Co. The new type cable is of high-voltage, paper-impregnated, lead-sheathed construction. In severe cyclic loading and aging tests simulating actual operating conditions, the new cable, called CB Cable, lasted twice as long as standard shielded cable.

The U.R.W.A. was selected as the exclusive bargaining agency at the plant of Republic Rubber at Youngstown, Ohio, last month. In an election conducted by the National Labor Relations Board, 398 votes were cast in favor of the U.R.W.A. and 296 for the Republic Rubber Employees Association.

Ohio Rubber Co., Willoughby, Ohio, has begun the construction of a plant addition which will provide 40,000 square feet of needed floor space. The new addition is planned to accommodate expected national defense orders. Ohio Rubber produced poison gas for the government in the last war.

## HYDROCARBON CHEMICAL CO. LISTS ROSTER OF OFFICERS

Ross W. Thomas, general manager of the Philgas Division of the Phillips Petroleum Co., was named president and general manager of the recently-organized Hydrocarbon Chemical & Rubber Co., following the first meeting of the new firm's board of directors in Akron on August 22. Dr. Waldo L. Semon, creator of Ameripol and Koroseal for the B. F. Goodrich Co., was named vice-president and director of research.

Herman P. Gangwer, a member of Goodrich's accounting department, was named treasurer of the new concern, and Hy Byrd, assistant secretary of the Phillips company, was appointed secretary. W. F. Avery, assistant secretary of Goodrich, and B. F. Stradley, secretary of Phillips, were elected assistant secretaries of Hydrocarbon Chemical, while Harry N. Stevens, former member of Goodrich's legal staff, was named patent attorney.

The board further announced the appointment of Frank M. Andrews, formerly of Philgas, as general sales manager, and W. D. Parrish, of raw materials control at Goodrich, as technical service engineer.

The company, organized by Phillips Petroleum and Goodrich for the purpose of manufacturing the principal ingredient of synthetic rubber from various raw materials, and the synthesis of such rubbers, will wholesale synthetic rubber in sheeted form to Goodrich and other manufacturers in the rubber industry.

### Uphold "Stonite" Patent Decision

A decision was handed down by the United States Circuit Court of Appeals last month on the appeal filed by the Cincinnati Rubber Mfg. Co. from the decision of the United States District Court in the suit brought by Stowe-Woodward, Inc., for infringement of the latter's patent on "Stonite" top press and smooth press rolls. The appellate court sustained the patent on all claims and affirmed the order of the lower court perpetually enjoining Cincinnati Rubber from infringing the "Stonite" patents and gave judgment for damages.

### Export Quota Increased

On September 9 the International Rubber Regulation Committee, meeting in London, announced an increase in the rubber export quota from 85 to 90% of basic quotas for the last quarter of the current year. The increase was made to further expedite the accumulation of emergency rubber reserves both in this country and in England. Under the 90% quota potential rubber supplies will amount to approximately 124,000 tons monthly from all rubber cultivation countries.

# NAMES IN THE NEWS

PROFESSOR CHESTER M. ALTER, of Boston University, has been engaged by the Vultex Chemical Co., Cambridge, Mass., as chemical consultant. DR. ALTER, who received his Ph.D. degree from Harvard University, is devoting a part of his time to general research and development problems.

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DR. A. ERNEST MACGEE, manager of the Solvents Division of the Skelly Oil Co., has been transferred from the Chicago office to the general marketing office of the company at Kansas City, Mo., where he will also be in charge of butane sales.

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FREDERICK J. HORN, formerly with W. R. Grace & Co. and the Meyer & Brown Corp., is now associated with Pagel, Horton & Co., Inc., importers and dealers, as manager of that company's newly established Rubber Department. For the past year MR. HORN was in business for himself.

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CHARLES J. ASTRUP, assistant sundries sales manager of the Miller Division of the B. F. Goodrich Co., Akron, was appointed sundries sales manager last month. He has been with the Miller Division for the past 19 years.

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WILBUR SHAW, famed auto race driver, has been named manager of the Aviation Division of the Firestone Tire & Rubber Co., Akron. In addition to his racing activities, MR. SHAW is widely known in the aeronautical field, at one time having operated a training school and passenger service line in Los Angeles.

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THOMAS W. CASEY, for 11 years vice-president and general manager of the Seiberling Latex Products Co., Barberton, Ohio, has become vice-president in charge of sales with the Acushnet Process Co., Acushnet, Mass., manufacturers of golf balls and other rubber products.

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O. L. BEISWINGER, assistant chief engineer, Goodyear Tire & Rubber Co., was elected president of the National Association of Power Engineers on August 23. He has been associated with Goodyear for the past twenty years.

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E. L. LUACES has withdrawn from active participation in the affairs of E. L. Luaces & Associates, industrial chemical consultants, and has established an office at 1107 Broadway, New York City, where he will engage in patent practice in the fields of chemistry, metallurgy and engineering. For five years he was in charge of engineering and patents for the Acticarbone Corporation.

CHARLES E. REYNOLDS, formerly chief chemist and technical superintendent of the Cambridge Rubber Co., has joined the Vultex Chemical Co., Cambridge, Mass. MR. REYNOLDS worked with the old Kenyon Tire & Rubber Co. from 1925 to 1927, then spent two years as technical superintendent of the Vulcan Proofing Company, and joined Cambridge Rubber in 1929.

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A. B. CLUNAN, manager, Packaging Division, Pliofilm Department, Goodyear Tire & Rubber Co., Akron, has been appointed to both the Packaging Council of the American Management Association and the Packaging Institute.

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REGINALD M. BANKS, until recently manager of the Organic Chemical Sales Department of the American Cyanamid & Chemical Co., has been appointed assistant to the president of the American Cyanamid Co., the parent concern. He will promote the coordination of research and sales activities.

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A. D. MCPHERSON, associated with the Los Angeles factory of the B. F. Goodrich Company for the past 12 years, has been transferred to the company's purchasing department at Akron.

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J. GLEN GAY, chief chemist, Miner Rubber Co., Granby, Quebec, Canada, has been given a leave of absence for the duration of the war. MR. GAY is a lieutenant of the 24/75th Field Battery, R.C.A., C.A.S.F., of the Canadian Army, and his unit has been called up for active service.

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WILLIAM P. LASETER has been appointed manager of the newly created export division of John A. Roebling's Sons Co., Trenton, N. J. Offices of the new division are maintained at 19 Rector Street in New York City. MR. LASETER was formerly associated with the Mexican subsidiary of the Oil Well Supply Co.

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FRANK T. MAGENNIS, vice-president of Goodyear-Argentina since 1936, has been appointed assistant manager of the Goodyear Export Co., with headquarters at Akron. A. E. PATTERSON is also an assistant manager of the export concern.

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ALAN W. BRYANT, chemist, Binney & Smith Co., passed out the cigars last month, the occasion being the birth of a boy to MRS. BRYANT on August 17. The youngster has been christened ALAN W. BRYANT, JR. Both mother and son are reported doing nicely.

### Named Chief Chemist of Dunlop

**Dr. Norman S. Grace**

Dr. Norman S. Grace, associated with the Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Canada, for the past year and a half, has been made chief chemist of that company, succeeding L. D. Carver, resigned. Prior to joining Dunlop, Dr. Grace spent several years with Gutta Percha and Rubber, Ltd., and two years with the National Research Council at Ottawa, where he worked under Dr. G. S. Whitby, now head of the Chemical Division of the National Physical Laboratories, Teddington, England. Dr. Grace was graduated from the University of Saskatchewan and did post graduate work in chemistry and physics at several universities. He is a Fellow of the Canadian Institute of Chemistry.

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### Dr. Cunningham Joins Columbia

Dr. G. L. Cunningham, research chemist at the Mathieson Alkali Works, Inc., Niagara Falls, N. Y., since 1930, has joined the technical service department of the Columbia Alkali Corp., chemical sales division of the Pittsburgh Plate Glass Co. At the same time it was announced that A. E. Daley has joined the sales staff and will operate as a representative on less than carload sales of Columbia products in the Chicago area.

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### Features Phosphorated Oils

A number of phosphorated oils, with characteristics and properties which make them of special interest to the rubber, paint, ink and other fields, is being featured by the Beacon Co., 89 Bickford St., Boston, Mass. These oils, which are said to have a number of advantages over sulphonated oils, may be used as emulsifying agents, dispersants, penetrants and wetting agents.

# FINANCIAL NEWS

### General Cable Corporation

First Half: Net profit of $1,495,581, or 52c a common share, which compares with a net loss of $170,279 last year. For the second quarter of 1940, the company reports a net profit of $768,156, equal to 29c a share on the common after dividends on the preferred and Class A stocks, which compares with $26,494, or 17c a share on the 7% preferred, in the same quarter of 1939.

### Thermoid Company

First Half: Net profit of $274,090, equal after preferred dividend requirements on 39,956 shares of $10 par $3 convertible stock on which there is an accumulation of unpaid dividends, to 45c each on 476,388 shares of $1 par common stock. This compares with $168,733, or 23c a share, in the corresponding period of 1939.

### Raybestos-Manhattan, Inc.

First Half: Net profit of $919,159, or $1.46 per share, after providing for depreciation and taxes. The profits of the company's wholly-owned Canadian subsidiary were not included in the report, since they had no material effect on the consolidated statement. They will be reported in the annual report.

### Hewitt Rubber Corporation

First Half: Net profit of $102,371, or 61c a share, which compares with $81,053, or 48c a share, last year. For the second quarter of 1940 Hewitt reports net profit of $63,994, or 38c a share, against 23c a share earned in the first quarter.

### Dewey & Almy Chemical Co.

First Half: Net profit of $272,773, equal to $1.02 each on 216,475 shares of common stock, which compares with $247,906, or $1.00 each on 191,775 shares, in the corresponding period of the previous year.

### Rome Cable Corporation

Second Quarter: Net profit of $60,570, equal to 32c a share on the outstanding stock, which compares with $45,993, or 24c a share, in the corresponding period of last year.

### Intercontinental Rubber Co.

First Half: Net profit of $157,591, which compares with $96,967 in the first six months of last year. The company's present business is understood to be quite favorable.

### Baldwin Rubber Company

Nine Months to June 30: Net profit of $402,167, equal to $1.27 each on 316,754 shares of common stock, which compares with $305,890, or 96c a share, in the nine months ended June 30, 1939. Baldwin has changed its fiscal year to June 30 instead of September 30.

### Canada Wire & Cable Co.

First Half: Net income of $380,000, equal to $1.51 each on 150,662 shares of Class B common stock after preferred and Class A dividend requirements, which compares with $154,838, or 21c each on Class B stock, last year.

### Anaconda Wire & Cable Co.

Second Quarter: Net income of $367,979, equivalent to 87c each on 421,981 shares of common stock, which compares with $131,293, or 31c a share, in the corresponding period of 1939.

### Belden Manufacturing Co.

First Half: Net income of $167,324, against $166,639 in the corresponding 1939 period, including $73,747 cash value on books. Net sales amounted to $2,760,431, against $2,214,504.

## Financial Briefs . . .

Monsanto Chemical Co. reports net operating earnings of $3,107,726 for the first six months of 1940, exclusive of a dividend of $270,375 received from its British subsidiary, which is equal to $2.30 a common share and compares with $2,061,065, or $1.46 a share, in the corresponding period of 1939.

Net profit of the American Cyanamid Co. for the first half of 1940 amounted to $3,024,128, equal to $1.11 each on 2,618,365 shares of $10-par combined Class A and B common stocks after allowing for dividend requirements on the preferred.

New Jersey Zinc Co. had a net profit of $3,318,268, equal to $1.69 each on 1,963,264 shares of capital stock, for the first six months of the current year, which compares with $2,047,648, or $1.04 a share, in the same period of 1939.

For the 28 weeks ended July 13, 1940, Flintkote Co. reports a net income of $621,470, equal to 92c each on 678,546 shares, which compares with $601,331, or 91c each on 672,996 shares, for last year's corresponding period. Net sales were $9,163,272 against $8,339,828.

### London Follows Rubber Terms

Following the recent lead set by the Commodity Exchange, Inc., of New York, the London Rubber Exchange on September 4 reported that sellers on the London market have been granted the option of delivering rubber in bales or cases. Under the new standard contract of the Commodity Exchange, which is now in effect, the seller has the option of delivering either one of the two deliverable grades at fixed discounts below the price of the base grade. London rubber circles, as well as those in the Far East, are said to have welcomed the concession since it brings London in line with the local practice of taking bulk requirements, thereby making possible a general standardization of packings.

### New Rubber-Like Material

Anchor Rubber Products, Inc., of Cleveland, Ohio, has developed a new rubber-like material to which the name "Anchorex" has been applied. According to Ben Kravitz, president of the company, Anchorex has a tensile strength which may reach 14,000 pounds, an elongation of 500%, and successfully resists the action of oils, greases, fats, petroleum solvents and hydrocarbons, water, mineral acids, alkalis and many high-boiling compounds. It is made from soybean proteins and petroleum derivatives, the identity of which is the company's secret. Anchor Rubber is said to have already produced several commercial products from the new material, particularly for the aviation industry.

### Inventory Bulletin Available

The Rubber Manufacturers Association, Inc., 444 Madison Ave., New York City, has made available a bulletin giving the recommendations of its General Accounting Committee with respect to the so-called "last-in-first-out" method of inventory valuation, which has been widely discussed in business circles since permission to use the method was granted, under certain regulations, by the Bureau of Internal Revenue in the Revenue Act of 1939. Copies of the bulletin, labeled G-429, have been mailed to all rubber manufacturers, but extra copies may be secured from the Association on request.

### Manhattan Acquires Property

To provide needed additional space for storage and steadily expanding manufacturing facilities, Raybestos-Manhattan, Inc., has purchased the plant of the Brighton Mills, which is adjacent to the main plant of the Manhattan Rubber Manufacturing division at Passaic, N. J. The property includes approximately five and one-half acres on which are buildings with 240,000 square feet of floor space. The announcement of the acquisition was made by F. L. Curtis, general manager of Manhattan Rubber.

### Insulated Wire Strikes Continue

Violence continues to mark the strike being conducted by the International Brotherhood of Electrical Workers, Local 3, against seven wire and cable companies in and around the Metropolitan New York Area. Rioting at the plant of the Triangle Conduit and Cable Co., at Maspeth, Long Island, early this month resulted in several strikers and non-strikers being injured and a number of arrests. The union, it is understood, is seeking higher hourly wages and fewer work hours per week. Several of the wire plants are continuing in operation despite the strike, while a few others are known to have shut down.

### Electrically Conductive Compounds

B. F. Goodrich Co., Akron, has developed specialized compounds of natural and synthetic rubber which possess a high degree of electrical conductivity. These compounds may be applied to the surfaces of natural rubber products like paint and will carry away static. Electrically conductive compounds, it is stated, can generally be made softer and more "rubbery" from synthetic rubber, while in the case of natural rubber the compound has to be "loaded" and consequently is stiffer and less yielding. The new material is reported to have been successfully used as a belt dressing to carry away static from transmission belts.

### New Carbon Black Bulletins

Godfrey L. Cabot, Inc., Boston, Mass., manufacturers of carbon black, is presenting a series of graphical presentations for distribution to those industries in which carbon black plays an important part, such as rubber, paint and ink. The material in these presentations, called "Industrial Highlights," will cover the manufacture of carbon black and its relation to particular fields of use. The first edition of these "highlights" has just made its appearance. It contains a number of interesting photographs, with fully descriptive captions, of various apparatus used in the different Cabot plants.

### Rubber Sleeves for "Iron Lung"

A new type of "iron lung," which weighs only 40 pounds as compared with over 600 pounds for the so-called "boiler type" respirator, is being used successfully to fight infantile paralysis. Invented by Dr. F. H. Terhaar, of Los Angeles, the new respirator looks like the chest protector of a suit of armor, and has rubber sleeves which fit tightly at the waist and arms of the paralysis victim, sealing in the necessary pulmonary air. Two features which favor Dr. Terhaar's respirator are the easy mobility of the device and the fact that it may be operated from either truck or airplane batteries.

### Largest Tires in Operation

The four largest tires ever built, made by the Firestone Tire & Rubber Co., Akron, made their world premiere appearance recently on the huge tournapull unit seen in the accompanying illustration. The unit, which has a scoop load sufficient to fill an ordinary garage, is being used in the construction of an airport in Georgia. The giant tires have a 33-inch cross-section, 34 plies of gum-dipped cord fabric, and a 104-inch overall. Each tire weighs as much as a small automobile.

Goodyear Tire & Rubber Co., Akron, has announced a coöperative policy for its employees keyed to the national defense program. Effective at once, all employees of the company who are voluntary members of the National Guard or Reserve Officers Corps and who are called up for training will be granted leaves of absence with two weeks' pay guaranteed.

Marathon Rubber Products Co., Wausau, Wisconsin, has purchased a 48 by 120 foot building near its present factory to provide additional manufacturing space. The new addition will give employment to approximately 100 more workers, according to J. L. Usow, president, bringing the firm's total payroll to about 450 employees.

Synthetic coal-tar chemicals for use in the compounding of rubber increased 60% in production in 1939, according to the U. S. Tariff Commission. Those used as accelerators were up 47% and those used as antioxidants 69%. Non-coal-tar rubber chemicals also increased considerably in production, but not so much as did those of coal-tar origin.

In view of the fact that any extensive attempt to use the highly-publicized wide base tire would throw a huge volume of work upon mold and tool shops in both the rubber and automotive industries, with the result that national defense might suffer, it is understood that all plans for the innovation as far as 1941 automobile models is concerned has been shelved.

Addition to its truck tire line of a new YKL rib, replacing the former designed with an all-rib style, has been announced by Goodyear, which points out that shoulder and body appearance of the tire remain unchanged.

### Synthetic Rubber in Italy

Another step is being taken by Italy to free that country from complete dependence upon imports for its rubber supply. The announcement has been made that the Societa Anonima Industria Gomma Sintetica has been formed to work with the Societa Italiana per la Produzione della Gomma Sintetica and the Instituto per lo Studio della Gomma Sintetica in the production of synthetic rubber. The new company will operate two large factories, according to present plans, the first using processes developed in Italy and the second German processes under special agreement with I. G. Farbenindustrie. One of the plants will be located in the Gualdo Cattaneo zone in Umbria.

### Cushion Type Tire

A new kind of industrial tire, combining the advantages of both pneumatic and solid types, has been perfected by the B. F. Goodrich Co., Akron, Ohio. Called the Silvertown Cushion Type Tire, it is filled with a cellular type of material which gives it high cushioning qualities. The new construction eliminates the hazard of tire failure because of punctures or leaky valves, and servicing, such as inflation or tire repairs, is also eliminated. The new tire is interchangeable on the same wheel with single-tube pneumatic tires of like sizes and at present is being adapted for light hand trucks, trailers, service station grease carts and similar industrial vehicles. Two sizes are now available—6x2.00 and 8x2.50.

### Approve Reduction in Stock

At a special meeting held in New York City recently, stockholders of the American Hard Rubber Company voted a reduction in the company's authorized capital stock from $5,900,500 to $5,318,400 and in the number of shares from 94,880 to 89,059 by reducing the number of its previously authorized shares of $100-par preferred stock from 23,130 to 17,309. They also approved a reduction in outstanding capital from $5,543,450 to $4,961,250 by cancellation and retirement of the 5,821 shares of 8% preferred stock previously issued and outstanding and now held by the company.

### New Japanese Synthetic Rubber

According to reports from Japan, one of the laboratories of the Mitsui Mining Company has succeeded in manufacturing a rubber compound from coal. One of these reports states that "the Mitsui rubber compound is obtained after applying a special chemical process, resulting in a synthetic rubber that is claimed to be strong and durable." The New York office of the Mitsui interests does not place too much credence on the reports.

# CANADIAN NEWS

Increasing production of army vehicles in Canada is beginning to give rise to a problem which Dominion rubber manufacturers will find difficult to solve. Mechanical transport vehicles destined both for the Canadian army as well as the armies of the Empire are now rolling off the assembly lines of the Ford and General Motors plants at the rate of 600 a day and this production is to be increased substantially before the end of the year. This means that about 3,000 tires are required daily at present all of which are of special types more difficult to build and cure than ordinary passenger or truck tires.

Airplane tires are another new line with Canadian companies since the early part of this year. Hon. C. D. Howe, Minister of Munitions and Supply, states that Canadian aircraft plants had orders for 3,200 planes at the end of July of which 257 had been delivered. Early in 1941, he estimates, the Canadian aircraft industry will be producing 360 planes a month. All of these, of course, will require special tires.

Government orders already granted this year or currently under negotiation total about 625,000 tires and tubes and more orders are in the offing. The government has bought and is setting up in three Canadian factories several million dollars worth of machinery and molds for making these special tires. With this assistance tire companies feel that they can handle all present army needs and the normal civilian requirements.

Tire-making equipment is being used at capacity, however, and if army needs increase as indicated a decision will have to be made in regard to further plant expansion and also in regard to the restriction of tire purchases by civilians.

The problem of obtaining adequate supplies of crude rubber for even normal business is also causing some concern. No trouble has been experienced as yet other than that three to four months are now required for rubber shipments to reach Canada. Shipments from the same sources before the war required only a month to six weeks. It is estimated that there is a six to seven month supply of crude now on hand in the Dominion which is slightly higher than normal.

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Canadian Goodyear recently leased 30,000 square feet of ground floor space from the Corrugated Paper Box Company at 187 Geary Avenue, Toronto. Pressure of business has given rise to the need for additional space.

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Arthur L. Brown, merchandising manager, has been appointed assistant general sales manager of the Northern Electric Company, Ltd., Montreal. Mr. Brown is widely known in the electrical industry as a result of having served three consecutive terms as president of the Canadian Radio Manufacturers' Association.

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Batawa has been chosen as the name of the village where the Bata Shoe Company of Canada, Ltd., is located in the Trent River Valley, not far from Frankford, Ontario. Construction of the village was undertaken by the company itself to provide living quarters for some of its more than 600 employees. The townsite development when completed will consist of fifty four-room bungalows and fourteen semi-detached two story houses. Of these, about fifty houses have already been completed. The construction project was made possible by a loan of $115,200 obtained under the Dominion Housing Act.

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Among contracts in excess of $5,000 granted during the month of August the War Supply Board granted a $10,400 order to the Miner Rubber Co., Ltd., Granby, Quebec, for rubber clothing.

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Word has been received from the Department of Commerce, Washington, D. C., that the division formerly known as the Automotive-Aeronautics Trade Division will be known in the future as the Motive Products Division. The division, of which Paul R. Mattix is chief, has been handling all foreign and domestic trade problems in connection with the aviation and automotive vehicle industries.

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The "Old Mill" of Chas. Macintosh & Co., Ltd., Cambridge St., Manchester, England, of historical interest to the rubber industry since it was at that mill that Charles Macintosh first began the manufacture of waterproof garments, was gutted by fire recently.

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The Battery Division of Thomas A. Edison, Inc., has acquired 16 acres of land along the Ohio River at Cairo, Ill., for expansion of its business in the west and midwest. The new site has five buildings, all of which will be renovated.

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Work has been started on a new $50,000 factory building in Cedar Rapids, Iowa, for the Midland Rubber Co. The new building, which is scheduled for completion by October 1, will enable the company to double its present capacity.

## PEACEFUL MISSION SERVED BY HOLLYWOOD "BALLOON BARRAGE"

Hollywood, California, is now protected by an efficient "balloon barrage." Unlike that of London, however, where the barrage is used as an air raid defense precaution, the barrage over Hollywood serves the peaceful mission of warning friendly commercial aircraft to stay away from the vicinity of movie company sound stages. Many valuable movie "takes" have been spoiled by the roar of airplane engines.

The balloons used over Hollywood, unlike the military variety which look like big, gray fish, are spherical in shape. Made by Goodyear, they are painted a vivid orange and each one has nearly 100 highly polished, light-weight metal reflecting discs, or mirrors, about four inches in diameter, secured to its surface at regular intervals.

Purpose of the mirrors is to reflect sunlight by day and searchlight rays by night, creating a dazzling effect for maximum visibility. The balloons are 12 feet in diameter, can be inflated with 950 cubic feet of helium gas, and will be tethered on rope flying lines 400 feet long so that they may be raised or lowered from desired location at will, just like the London barrage balloons.

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The official creation of the Illinois Institute of Technology, representing a merger of the Armour Institute of Technology and Lewis Institute, both of Chicago, was heralded on July 24 in the form of the first meeting of the Board of Trustees of the new institution. Henry T. Heald, for two years president of Armour Institute, was elected president of the new institution.

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Net profit of $174,040, equal after dividend requirements to 13c each on 673,088 common shares, is reported by the American Zinc, Lead & Smelting Co. for the second quarter of 1940. This compares with $79,600, or $1.17 a share, in the preceding quarter.

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Buxbaum Co., Akron, manufacturer of tire repair materials, has filed suit against the Baltimore & Ohio Railroad, in conjunction with six insurance companies, for damages incurred in the fire which swept the Buxbaum plant in March of last year. Sparks from a passing locomotive were blamed for the fire. The amount of $74,612 is involved.

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According to William E. Bruyn, treasurer and director of Littlejohn & Co., $5,491 has been raised by the Rubber Section of the Industry Division of the Greater New York Fund in the current year's campaign. F. B. Davis, Jr., president of the U. S. Rubber Co., is chairman of the Fund's Industry Division.

# LOS ANGELES NEWS

Curtis Welborn, secretary of the Underwriters' Laboratories, Chicago, spent the early part of September in Los Angeles. His chief business here was in connection with regular inspection of products of Western Insulated Wire, Inc., all of which were given top grades in their classifications.

George Sherry, representing the office of the president of Goodyear, accompanied by three assistants, spent the first part of September in Los Angeles. The three assistants were Fred Page, Fred Hoopes, and E. J. Mackey.

Re-arrangement of offices in the Kirkhill Rubber Company plant will add 1,200 square feet of floor space to the office set-up. Better ventilation and greater efficiency are the keynotes. During the past month a tuber and a new mill have been added to the mechanical equipment in the plant and 3,500 square feet has been added to the warehouse facilities. Gross sales in August topped every month since the company was established. The pay-roll today shows 284 employees.

Sherman G. Burgess, whose service with Goodyear dates from early in 1931, has been transferred from the time study department in the Los Angeles plant to the labor department in the Akron plant.

Charley Lamb, vice-president and general manager of the West American Rubber Company, will spend most of the month of October in New York on a business mission. New equipment installed at the plant of this company during the past month includes a new hydraulic pump and other minor items. Business is good, Mr. Lamb reports, with two shifts running.

A. D. Mast, Jr., president of Western Insulated Wire, Inc., has returned from a trip to Chicago where he transacted business and visited friends and relatives.

Bill Haney, foreman for the Kirkhill Rubber Company, is back from another trip to Iowa and Chicago. He found his father who lives in Iowa in very poor health.

Golden State Rubber Mills, Inc., have completed installation of two new presses and other mechanical equipment necessary to meet increasing production demands. A. S. Rocklen, general manager, says business is good.

Fred F. Freeman is the new night superintendent at Goodyear, having been promoted from the department of production control.

Ed Royal, local manager for H. M. Royal, Inc., spent five days in San Francisco on business early in September.

Jack Burns, well known among Los Angeles rubber men, who has been working in recent years as a ferrying airplane pilot making several trips each month across the American continent, has received a commission in the Canadian Air Force as an instructor and was scheduled to leave for Canada about the middle of September. He was connected with the MacClatchie Manufacturing Company for ten years.

The local Goodrich plant was shut down for two weeks beginning on Monday, August 26, while a large mass of new equipment was being installed. Employee vacations were taken care of quite largely in this interim.

Athletic events are assuming real importance among local rubber factories this fall. A golf tournament is now well under way among the "Big Four." These are ten-men teams and six matches are scheduled. Two have been played at this writing. At the U. S. plant an inter-department bowling league is set to get under way late in September. Eighteen teams will compete over a 34 week period. U. S. is also competing in the Southeast Industrial Athletic Association League. There are fourteen teams competing in this tournament and 28 games will be played. A team likewise has been entered in that league's baseball tournament. Badminton, horseshoes, and basketball are also getting underway in the plants.

Patrick J. Madgwick, plant superintendent for Latex Seamless Products Company, died in the Canadian government hospital at Brantford, Ontario, on Sunday, August 11, following an operation for stomach trouble. Funeral services were held two days later in Brantford. Mr. Madgwick, although a United States citizen, served with the Canadian forces during the World War. He was about 45 years old and leaves a son 17 years old in addition to his widow. Carl E. Stentz, proprietor of the company, has named Harry Ross as Madgwick's successor. Ross has been with the company about 8 months.

The first annual supper meeting of the Los Angeles Rubber Group is scheduled for Tuesday evening, October 1. While details of the program have not been announced a good attendance is anticipated. The suppers have been held monthly for many years with increasing interest in the programs being evident. The membership of the group has also greatly increased from year to year.

*Automobile Topics,* oldest unit of the automotive trade press, has been sold by its publisher, Frank W. Roche, to William C. Cowling, formerly general sales manager of the Ford Motor Co. and more recently executive vice-president of the Willys-Overland Co.


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# OBITUARIES

### *Edouard Michelin*

Edouard Michelin, the last member of the famous Michelin family, founders and operators of the world-wide Michelin Tire Company, died at his home in Orcines, France, on August 25, at the age of 84. At the time of his death he was actively managing the affairs of the French Michelin concern.

Edouard Michelin, with his elder brother, the late André Michelin, established the Michelin Tire Company in Clermont-Ferrand, France, in 1888. Original production was devoted exclusively to bicycle tires, and in 1891 the company introduced the first demountable bicycle tire. Shortly thereafter Michelin entered the tire manufacturing field and was a leading pioneer in the development and introduction of the balloon tire.

André Michelin died in 1931 and shortly thereafter Edouard Michelin retired from the business, turning it over to his two sons, Etienne and Pierre. Etienne died in an airplane crash in 1932 and Pierre in an automobile accident in 1937. Upon the death of his second son, Edouard resumed direction of the company, despite his age.

In 1907 the Michelin concern organized an American manufacturing subsidiary at Milltown, N. J., under the direction of Jules Hauvette Michelin, nephew of the founding brothers. Jules was in active charge of the plant from 1907 until 1930 when it was closed as a result of declining business and low-price competition. During its 23 years of existence the Milltown plant employed an average of 1,800 workers and developed a model community of 350 workers' homes. Jules died in December, 1937.

During the operation of the Milltown plant the name of Michelin became familiar throughout the United States, particularly through the distinctive symbol used in the company's extensive advertising, a comic, rotund figure of a man made entirely of automobile tires of different sizes, piled horizontally.

Both Edouard and André Michelin were greatly interested in aviation and foresaw its tremendous development in both commerce and warfare. At the time the Versailles treaty was being drawn they argued that it should prohibit Germany from having any commercial aviation whatever, or, at most, a very small amount. Although the treaty forbade the use of military aircraft to Germany, the Michelins pointed out the ease and rapidity with which a peacetime airplane could be transformed into a bomber. They even pictured conversions leading to raids on London, Paris and Brussels.

### *David H. Bridgwater*

David H. Bridgwater, an electrical engineer employed by the Electric Machinery Mfg. Co., of Minneapolis and New York City, formerly connected with the Electric Motor & Repair Co., of Cuyahoga Falls, Ohio, brother of E. R. Bridgwater, manager, Rubber Chemicals Division, E. I. du Pont de Nemours & Co., and B. E. Bridgwater, of the Bridgwater Machine Co., was killed at East Farmingdale, L. I., N. Y., on August 20 while inspecting an electrical installation in the plant of a dyeing company. Mr. Bridgwater had been sent to the plant to determine the reason for excessive power consumption.

A graduate of Stow High School and Rensselaer Polytechnic Institute, young Bridgwater entered the employ of the Electric Machinery Mfg. Co. about one year ago. He was a member of the Delta Tau fraternity. Funeral services were held in Cuyahoga Falls on August 23, with interment in Oakwood Cemetery. In addition to the two brothers mentioned, another brother and mother and father survive.

### *Paul G. Himmelright*

Paul G. Himmelright, president of the Monarch Rubber Co., Hartville, Ohio, died on August 31 at Mercy Hospital in Hartville while undergoing an emergency abdominal operation. He was 50 years of age. A native of Piqua, Ohio, Mr. Himmelright was graduated from Miami University. He came to Canton about 27 years ago and was associated with Monarch Rubber for the past twenty years. It was largely through his efforts, and those of his brother Robert, that the small plant developed into one of importance in the industry. At the time of his death Mr. Himmelright was president of the Congress Lake Country Club, and a director of the First Trust & Savings Bank of Hartville. Funeral services were held on September 3 with interment in Westlawn Cemetery. He leaves a widow.

### *Edward W. Smith*

Edward W. Smith, manager of the development and design departments of the Electric Storage and Battery Co., Philadelphia, died on August 26 at his home in Germantown after a year's illness. He was 65 years of age. Mr. Smith was graduated from the University of Pennsylvania in 1897 and in 1901 received the first degree in electrical engineering ever conferred by that university. He leaves a widow, three daughters and two sons.

### *William G. Klauss*

William G. Klauss, former president of the defunct India Tire Co., of Akron, died at his Congress Lake home in Hartville, Ohio, on August 27 at the age of 63 following an illness of two months. He had been retired for the past five years, spending his summers at Congress Lake and his winters in Florida.

A native of Pittsburgh, Mr. Klauss started his business rise with the Johns-Manville Corporation, first acting as manager of the Southwestern district, with headquarters in St. Louis. He later went to New York as general manager of the company. After leaving Johns-Manville, Mr. Klauss became president of the Federal Match Company of Chicago, holding that position until he became president of India Tire. He figured prominently in the long fight to keep the India organization intact through all of its financial problems, but the company's assets were finally sold at auction to satisfy creditors in 1936.

Mr. Klauss was a Knight Templar and a Shriner. His membership in the Congress Lake Country Club was the only club connection he maintained after his retirement. Funeral services were held at the home on August 29, with cremation in Cleveland. He leaves a widow, a son and two daughters.

### *James W. Partington*

James W. Partington, vice-president and treasurer of the Passaic Rubber Co., Inc., Clifton, N. J., died at his home in Clifton on July 28 as the result of a heart attack. He was 73 years old. Born in West Brighton, Staten Island, N. Y., Mr. Partington was associated with the bleaching industry from 1882 to 1897. In the latter year he joined the Okonite Company and remained with that concern until 1920, spending many years in charge of the tape department. In May, 1920, Mr. Partington and Henry C. Mathey, also an Okonite employee, formed the Passaic Rubber Co. to manufacture rubber tapes. The business was first operated in Passaic, N. J., and later moved to Clifton at which time a mechanical goods division was added. Mr. Partington was a member of Unity Lodge, F. & A. M., Lonsdale, R. I. Funeral services were held on July 31 with interment in Ridgelawn Cemetery. He leaves a widow, two sons and a daughter.

### Seeks Footwear Materials

The firm of Olivero & Cia, Calle V. Lopez 302, Martinez, Argentina, intends to enter the manufacture of rubber footwear in the early future. The company is interested in securing prices and samples of compounding ingredients, raw materials, chemicals, etc., used in the manufacture of footwear, from American manufacturers. All data should be sent direct to the company in Martinez, Argentina.

# NEW NOVELTIES and SPECIALTIES

### Davis Wide Vision Mask

A new molded rubber mask, featuring wide vision in all directions with the lenses set at such an angle that there will be no reflections on one lens to ob-

struct vision when the light is coming from the opposite side, has been announced by the Davis Emergency Equipment Co., 55 Van Dam St., New York City. The outline of the mask, according to the manufacturer, is such that it will fit all sizes and shapes of faces and make a tight seal with but slight tension of the head straps. The small dead air space within the mask is said to make for a minimum of rebreathing, thus lessening the tiring effect of wearing the mask over long periods, this being of considerable importance when the mask is used with canisters. The clarifying tubes, through which the incoming air is passed over the lenses, are integrally molded into the mask.

### Scotch Purses

One of the more popular premium items of rubber made by the Golden State Rubber Mills, 657 East 61st St., Los Angeles, California, is the Scotch Purse. This item, a practical holder for

coins, keys and small articles, is circular in shape and made with holes which are small enough so that the smallest coin cannot be shaken out yet stretchable enough so that a silver dollar may be admitted or removed easily. When keys are inserted, they may be used without removing them from the purse. When used for advertising purposes, the advertising message is not stencilled or cemented on to the purse, but rather the imprint is permanently vulcanized with rubber ink during the molding operation. In this manner, the message cannot be torn off or rapidly dissipated.

### Drednaut Handle Grip

Made of semi-soft rubber, shaped to conform to all standard tool handles, the Drednaut Handle Grip was recently introduced by the Safety Equipment Co., 1228 St. Clair Ave., Cleveland, Ohio. The device, which is supplied with a screw and a washer for attaching to handle, prevents slipping of hammers and other tools from the workman's

grasp by permitting him to have a firm grip at all times no matter how hard a blow he strikes. The grips are easily applied and become a permanent part of the handle. They eliminate the use of sticky tape and other makeshift materials often used on hammer and other tool handles.

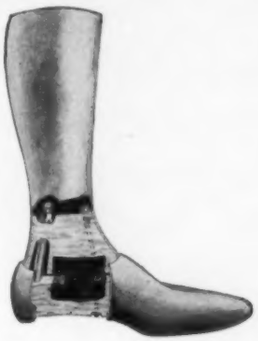
### I. T. S. Tuffies

A complete new line of "Tuffies," very thin heel lifts for French and Cuban heels, has been introduced by the I.T.S. Co., Elyria, Ohio. Included among the features claimed for the new heels by

the company are the following: Handsome new face design, extra thin for neat appearance, full concave-convex for tight joint, rubber that won't sag, and molded-on fibre backs which prevent heel cover bulge. Tuffies come packed 12 pairs to the carton, each pair in a separate envelope with nails, ready for quick and easy attaching. A handy size chart is being distributed by the company.

### All-Rubber Ankle Joint

A light-weight, pliant, all-rubber ankle joint was recently perfected and placed on the market by the Minneapolis Artificial Limb Co., 410 Sixth Ave. S., Minneapolis, Minn. By means of grooves



cut into each end of the joint, once it is installed in an artificial foot the wearer can step with ease on the toe or heel, the grooves closing as weight is brought down and springing open when the weight is released. Due to the all-rubber construction and the 2¼-inch thickness of the rubber used, lateral motion is also afforded by the new joint. Accordingly, the wearer can walk up or down hills, or step on a lateral slant, his foot pressing flat on the surface at all times. Another advantage of the device, which is called the Life-Like Lite Ankle Joint, is that when worn the foot never appears unnatural or at an awkward angle.

### Tu-Tone Rubber Rug

Identified as the Tu-Tone Rubber Rug, a new, heavy-duty, protective floor covering, which may be applied to practically any size or shape of floor, has been introduced by the Goodyear Tire &

Rubber Co., Akron. It is made in rolls 54 inches wide and 30 feet long and can be cut and matched to fit any desired area. Overall thickness of the rug is 5/16ths inches and it is said to be adequately heavy to eliminate "creeping" or "crawling." The two-tone effect is achieved by the ribbed design, the ribs being arranged diagonally across panels 9 by 12 inches. The new rugs are available in black, red or green.

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**Non-toxic** in rubber.

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**A little goes far** — In general, 0.5% by weight is sufficient to impart antiseptic action.

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**Do not contain mercury or any metallic salts.**

The above properties were revealed as a result of many reliable tests. In some cases slight changes in the compounding of the rubber may be necessary.

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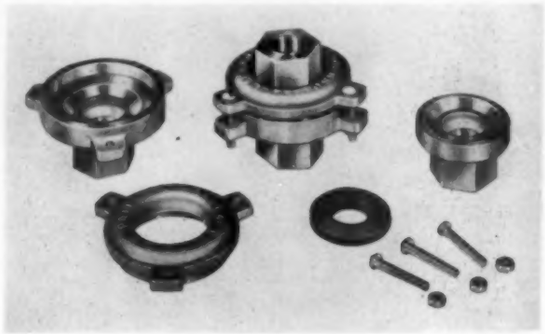
# NEW EQUIPMENT

## New Swing Joint for Steam Lines

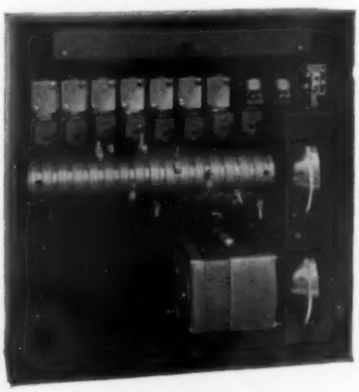
A simple and effective swing joint for handling steam pressure up to 100 pounds has been developed by the Patterson-Ballagh Corp., 1900 East 65th St., Los Angeles, California. It was developed primarily



for the company's own rubber molding equipment, but proved so successful that it is being made available to other rubber manufacturers by the company. The sealing unit of the new joint is a specially shaped and compounded rubber gasket which contains a percentage of very finely divided metallic lead, milled directly into the rubber. Because the lead acts as a lubricant, the joint turns freely under pressure. The gasket is expanded slightly by heat, which helps to maintain a perfect seal. By equipping steam lines with a swing joint of this type, a flexible connection is maintained by the pipe to actuate movement of mechanism. The joint is made of heavy bronze, weighs approximately 4½ pounds, and is available only in the ¾-inch straight style. The accompanying illustration shows the joint in both unassembled and assembled form.

## Taylor Flex-O-Timer

Adaptable for all-electric, all-pneumatic operations, or combinations of both, the new Taylor Flex-O-Timer just introduced by the Taylor Instrument Com-

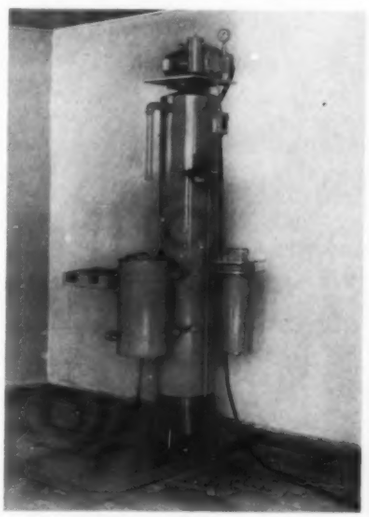


panies, Rochester, N. Y., is said to permit maximum precision of timing with minimum labor and expense. Extreme flexibility is obtained by the use of adjustable pins on the revolving drum. Cam cutting is elimi-

nated and the actuating pins are easily and precisely adjusted in circumferential undercut grooves on the one-piece drum and locked in place with a screw. The air valve or switch can be turned on and off, or vice versa, within ½ of 1% of total cycle time by means of this extreme adjustability. A new latch-trip solenoid operated mechanism starts the process instantaneously. This actuates one or more snap operators to start the timer motor which is of the high torque, fan cooled synchronous type, and any outside electrical or pneumatic functions to be performed simultaneously at the start of the cycle. An external push button or limit switch can be used to provide the electrical contact to start this process. Where the diversity of the products being processed requires considerable variation in processing time, Taylor Flex-O-Timer offers a varying drum speed rotation. The drum is directly run by a spur gear train, but a unique dog-and-latch mechanism provides 78 different drum speeds with each gear train ratio. Yet the drum speed is fixed and positive for any given setting and can vary only as the frequency of the electrical supply changes. Models are also available with a fixed speed gear train.

## Cry-O-Vac Locker Plant Packaging Unit

A specially designed locker plant packaging unit to simplify and speed up the application of Cry-O-Vac bags has been developed by the Dewey and Almy Chemical Co., Cambridge, Mass. Cry-O-Vac bags are sacks of specially compounded, purified latex, de-



veloped by the company. The new packaging unit is supplied with four cans so that they can handle 1 to 2 and 18 to 20 pounds of food in the various sizes of bags supplied by Dewey and Almy. The unit has a motor and vacuum pump for creating vacuum in a reservoir tank, a master vacuumizing can which is rigidly attached to the tank, holders for other cans when not in use, a box for storing bags in handy position, foot pedal controlling vacuum for expanding bags, a vacuumizing nozzle for exhausting air from within package, hand valve controlling vacuum for exhausting air from package, and a heat seal block for sealing the bag end. It is operated by a ¼ h.p., 110-volt A.C. motor. [ For a complete description of Cry-O-Vac bags see RUBBER AGE, April, 1939].

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Commercial Rubbermakers' Sulphur, 99½% Pure

TUBE BRAND
Refined Rubbermakers' Sulphur, 100% Pure

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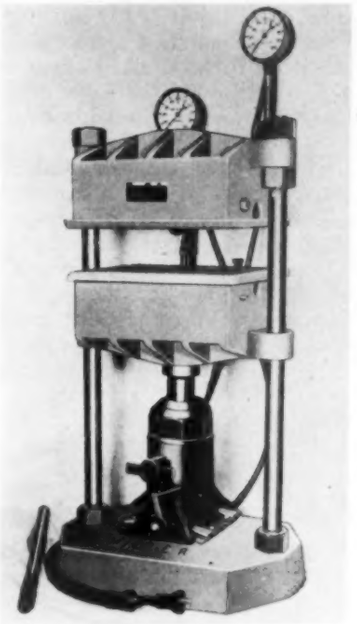
## Miller Hydraulic Press Vulcanizer

An hydraulic electric press vulcanizer, with which a regular hydraulic 6 to 10-ton jack can be used, designed for specialty rubber plants and laboratories for



molding soft and hard rubber and plastic products, has been developed by the C. E. Miller Mfg. Corporation, Anderson, Indiana. The vulcanizer stands 30 inches high, weighs 270 pounds, and is built to operate on either 110 or 220 volt a.c. circuits. Each plate is electrically-heated, generating steam pressure which is controlled by two automatic gauges. The heating units are rock wool insulated. The hand-operated hydraulic jack requires only a few strokes of the handle to produce tons of pressure. The press plate is lowered by opening the release valve.

## New Type of Magnetic Separator

An unusual type of magnetic separator which utilizes alternating current for energizing the magnetic field has been designed by the Stearns Magnetic Mfg. Co., Milwaukee, Wis., and styled Type "AM". By this method of energization with alternating current fields pulsating, the lines of force change 60 times a second, while the material affected by the magnet receives 120 pulsations of constant agitation. This Stearns separator is said to be particularly effective for treating finely ground powdered metal which may be contaminated by any number of impurities such as oxide, scale, charcoal, silica and other foreign particles.

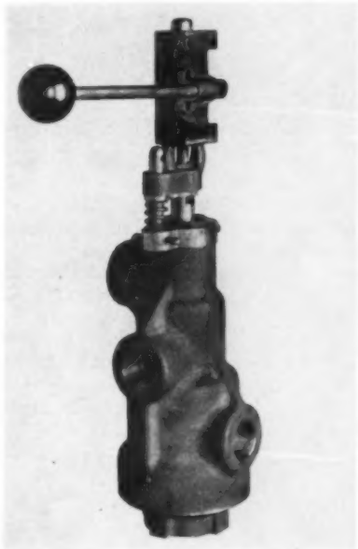
Material is spread uniformly by an adjustable vibrating feeder which provides even distribution of the material on the separator belt, where it is picked up by the magnet and carried along the underside of the separating belt. The high pulsating effect of the magnet frees the non-magnetic impurities allowing them to drop out. Under ordinary conditions three products can be produced—tails, middlings, and concentrates.

While the separator is fully enclosed in a structural steel frame practically dust-tight, provision is made for

removable panels by which the material can be inspected while the separator is in operation. Bearings requiring oiling and other attention are mounted on the outside for ready accessibility. An exhaust fan is directly attached to remove dust from the material while in process. The Type "AM" alternating current magnetic separators are designed in various sizes to suit the capacity of the equipment.

## New Bowes Three-Way Valves

Several mechanical improvements have recently been incorporated in the Bowes Three-Way Valves featured by the Seely Instrument Co., Inc., Akron, Ohio. These valves are closed neutral valves, a down stroke of the handle exhausting and an upstroke admiting pressure. Ease of operation is accomplished by small pilot valves which utilize internal water pressures to open the main passages. Pressure tightness is obtained by a method exactly opposite to normal practice. Instead of hard discs, a comparatively soft disc re-forms to the seat at every closure. The soft discs are completely shielded from abrasion and wire drawing, and yet smooth flow of water is assured. The Bowes Valves, the mechanical wearing surfaces of which are of hardened steel, may be mounted vertical or horizontal and the operating handle may be rotated throughout 360 degrees to be set in the most convenient operating position. A 45 degree movement of the handle will open either the exhaust or inlet seats to more than pipe capacity.



McDonnell & Miller, Wrigley Building, Chicago, Ill., has announced the **McDonnell No. 29 Safety Valve** which is said to give the same protection to hot water boilers that boiler feeders and cut-offs give to steam boilers. The new valve has only two positions—wide open or tight closed.

•

A new line of one and two-button **standard-duty-push-button stations** has been introduced by the General Electric Co., Schenectady, N. Y. The new stations, similar in appearance to the company's heavy-duty stations, are 4-9/16 inches high, 2-⅝ inches wide, and 2-½ inches deep.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# REVIEWS

## BOOKS

**Scientific Price Management.** By Allen W. Rucker. Published by the Eddy-Rucker-Nickels Co., 1400 Massachusetts Ave., Cambridge, Mass. 10 x 12½ in. 22 pp., plus charts. $5.00.

The first phase of price management, that dealing with pricing moves in decisions involving a direct or indirect concession in price without any reduction in direct costs and decisions involving increases in direct costs without any change in the regular price, is treated with in this manual. Unlike most books dealing with prices, the manual contains no theory whatever. It is best described as a direct, concrete and practical approach to realistic management of price problems encountered in all business. Fifteen different types of price problems are used for case histories. Of special interest is the inclusion of the Eddy-Rucker-Nickels Calculator Charts, designed for universal application in pricing problems. The charts, incidentally, are printed in two colors on index bristol board.

•

**Rubber Producing Companies — 1940.** Compiled by the Mincing Lane Tea & Rubber Share Brokers' Association, Ltd. Published by The Financial Times, Ltd., 72 Coleman St., London, E. C. 2, England. 5¼ x 8 in. 614 pp. 8s/1½d (approximately $2.00).

The latest revised edition of this "Official Guide for Investors in Rubber Shares," contains details on approximately 550 separate undertakings. Data given includes forward sales, capitalization per planted acre, investments and reserves. A valuable feature is the analysis of results of each estate for the past few years, many of them extending up to the end of 1939. These analyses show estate areas, standard outputs, annual production, gross price, "all-in" cost, net profit, dividends, and carry-forwards. Directors, officers and secretaries of each plantation operator are given wherever possible. Although primarily devoted to companies engaged in rubber cultivation, concerns with interests in tea, coffee, coconuts and palm oil, supplementary to their interest in rubber, are also listed.

•

**Handbook of Mathematical Tables and Formulas.** Compiled by Richard Stevens Burington. Published by Handbook Publishers, Inc., Sandusky, Ohio. 5¼ x 7¾ in. 282 pp. $1.25.

This is the second edition of the handbook compiled by the author. Like the first, which was published in 1933, it is divided into two parts, the first containing a careful summary of the more important formulas and theorems of algebra, trigonometry, analytic geometry and calculus, while the second contains the usual logarithmic and trigonimetric tables to five places, and tables of natural logarithms, exponential and hyperbolic functions, reciprocals, and other numerical qualities. An improved table of squares, cubes, square roots and cube roots has been incorporated in the new edition. The handbook, incidentally, forms the appendix of Lange's "Handbook of Chemistry."

•

**The Story of Cotton.** Bibb Manufacturing Co., Macon, Georgia. 6 x 9 in. 52 pp.

The manufacture of various textile materials from cotton as practiced in the mills of the Bibb company are interestingly traced and told in this booklet. Methods of inspection and testing are outlined; advantages of certain materials made by the company, such as HR Process Cords for use in tire manufacture, are stressed; and commercial policies of the company are discussed. The booklet is profusely illustrated.

# MICRONEX
# *Beads*

## HOW WELL DO THEY BREAK DOWN?

FOR THE ANSWER TURN THE PAGE...

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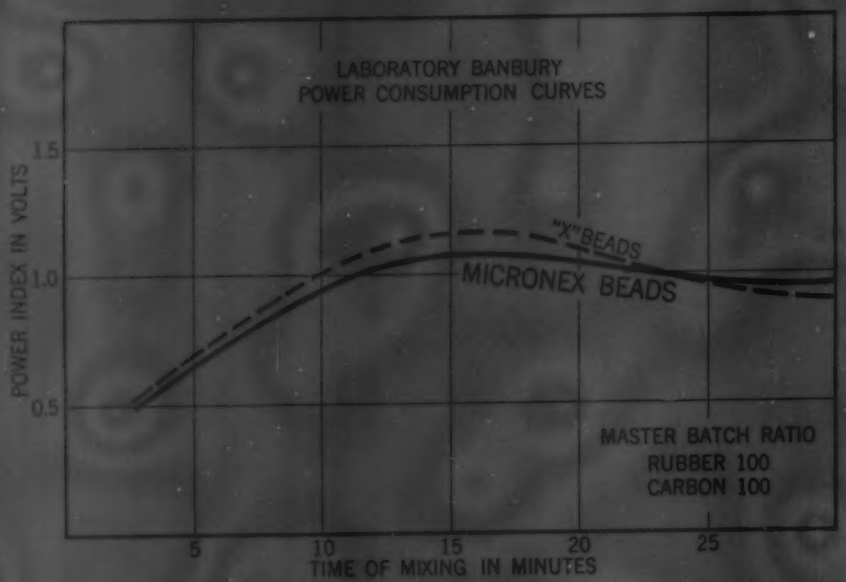
DIFFERENCES in despersing properties of carbon black beads are shown in the power consumption test as developed in our own laboratories. A comparison between Micronex Beads and a competitive product of equal particle size is shown in the following graph.




**Conclusion:** The power consumed (area under curves) for Micronex Beads is less than that of the competitive material. This indicates that Micronex Beads disperse more readily.

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•

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MICRONEX MEANS MORE MILEAGE

## BOOKLETS, CATALOGS, Etc.

**Rubber: History, Production and Manufacture.** By P. W. Barker. Published by Bureau of Foreign & Domestic Commerce. 6 x 9 in. 48 pp. Available from Superintendent of Documents, Washington, D. C., at 10c a copy.

Each year the Leather & Rubber Division of the Bureau of Foreign & Domestic Commerce receives hundreds of requests for information of a general character pertaining to rubber. These inquiries are received from rubber manufacturers, importers and dealers, from brokerage and investment houses, from college and graduate students, and from the general public. It is with these inquiries in mind that the current booklet was prepared. Two earlier editions of a general circular on rubber have been completely exhausted. The new booklet is devoted largely to the subject of the production of rubber rather than to manufacture of rubber products. After a brief history of the industry is given, various plantation methods are discussed. Some space is also devoted to a discussion of restriction. Several statistical tables are included.

•

**Defense of the United States and Other Nations in the Western Hemisphere: Rubber.** 6 x 9 in. 32 pp. Available from Superintendent of Documents, Washington, D. C., for 10c a copy.

This is a printed record of the testimony given by John L. Collyer, president, B. F. Goodrich Co.; W. S. Farrish and Frank A. Howard, representing the Standard Oil Co. of New Jersey; and E. R. Bridgwater, manager, Rubber Chemicals Department, E. I. duPont de Nemours & Co., Inc., presented to the Committee on Military Affairs of the U. S. Senate on June 14, 1940, on S. 4082, a bill to provide for the defense of the people of the United States and other nations in the Western Hemisphere as may desire the cooperation and assistance of this country. The testimony given comprises an interesting report on the current status of synthetic rubber manufacture in the United States, as well as its possibilities in the event of any emergencies. Like all records of hearings, it is printed in question-and-answer form.

•

**Automobile Facts and Figures: 1940.** Published by the Automobile Manufacturers Association, New Center Building, Detroit, Mich. 5½ x 8½ in. 96 pp.

This latest edition, the twenty-second to be published, contains new perspectives on the motor transport of the United States, emerging from the state-wide highway planning surveys. Not only is considerable new data on highway use given, but the booklet includes a detailed inventory of the street and road systems of the country, presented in figures and maps from the U. S. Public Roads Administration. Other data includes urban family expenditures for automobile transportation, production required to supply automobile replacement demand, employment created by various branches of the automotive industry, and statistics on the use and registration of passenger cars, trucks and buses.

•

**A Ready Reference for Plastics.** (Revised Edition). Boonton Molding Co., Boonton, N. J. 7½ x 10½ in. 50 pp.

This interesting booklet is offered as a concentrated compendium of information from the buyer's angle on plastic materials. It is replete with statistical data pertaining to the properties and characteristics of many of the commercial plastic materials available, including hard rubber and the so-called synthetic rubbers, all of which is presented in easy-to-understand, easy-to-read style. Of particular interest are composite tables showing the specific gravity, refractive index, tensile strength, modulus of elasticity, and other characteristics of the materials discussed.

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## REVIEWS (CONT'D)

**Small Inertia-Type Machine for Testing Brake Lining.** (Reprint). By Rolla H. Taylor and William L. Holt. National Bureau of Standards, Department of Commerce, Washington, D. C. 6 x 9 in. 16 pp. Available from Superintendent of Documents, Washington, D. C., for 5c per copy.

Construction, operation and results of a machine of the inertia type, the operation of which consists in bringing a flywheel up to a predetermined speed at equal intervals of time and stopping it by means of a brake mechanism which employs the lining under test, is described in this reprint. The original article appeared in the May, 1940, issue of the *Journal of Research*, published by the National Bureau of Standards.

•

**1939 Accident Rates in the Rubber Industry.** National Safety Council, Inc., 20 North Wacker Drive, Chicago, Ill. 8½ x 11 in. 8 pp.

Data pertaining to accidents in the rubber industry during 1939, based on reports received from 53 plants whose employees worked 130,336,000 man-hours during the year, is given in this bulletin. According to the bulletin, standings of the rubber industry during 1939 were 10th in frequency and 5th in severity among 30 major industries, as compared with rankings of 5th and 3rd for 1938. The frequency rate for the rubber industry in 1939 was 8.02 as compared with 11.83 for all industries, while the severity rate was .60 against 1.42.

•

**Circo Light Process Oil for Neoprene and Natural Rubber Compounds.** Industrial Products Department, Sun Oil Co., Philadelphia, Pa. 8½ x 11 in. 5 pp., with chart (Mimeographed).

This bulletin supplements that issued by the company last year which described process oils developed by the company for neoprene compounding. It is confined primarily to an enumeration and description of the plasticizing properties of one of these special oils — Circo Light Process Oil — with emphasis placed not only on the special advantages of this oil in neoprene compounding but in natural rubber as well. Procedures for incorporating the oil in the mix are given.

•

**Hewitt Rubber Products for the Oil Marketing Industry.** Hewitt Rubber Corporation, Buffalo, N. Y. 8½ x 11 in. 12 pp.

Various types of hose, including oil suction and discharge, sea loading, tank truck, fuel oil, propane-butane, curb pump and vacuum brake hose, are illustrated and described in this new catalog. It is actually one section of a general catalog, with two other sections scheduled for early publication, one on products for the oil producing and refining industry and the other covering all miscellaneous Hewitt products for general industry.

•

**How to Determine Where Overhead Materials Handling Equipment Can Be Used Profitably.** Cleveland Tramrail Division, Cleveland Crane & Engineering Co., Wickliffe, Ohio. 8½ x 11 in. 12 pp.

The title of this bulletin is indicative of its contents. The bulletin, however, includes a discussion on the elements of a materials handling system and the preparation of a simple layout. Several interesting installation views are shown, including one of the interior of the tire department of one of the larger rubber manufacturers.

•

**Goodrich Camelback.** B. F. Goodrich Co., Akron, Ohio. 8½ x 11 in. 12 pp.

This new booklet on the company's camelback for the retreading and recapping trade shows die sizes and curing schedules. In addition, the various grades marketed by the company are described, with special advantages emphasized. Methods of testing camelback are also given.

**Fire: Its Cause, Prevention and Control.** By Harold Joe Davis. Written and published by the author at 3927 East Admiral Place, Tulsa, Oklahoma. 6 x 9 in. 16 pp. 25c.

As indicated by the title, this booklet discusses the chemical cause, prevention and control of fire. After classifying the types of fires, he discusses various successful extinguishing agents, including sand, soil, salt, talc and other agents on small fires. Suggestions for the fireproof construction of various structures are included.

•

**Sellstrom Eye Protectors.** (Catalog No. 18.) Sellstrom Manufacturing Co., 615 North Aberdeen St., Chicago, Ill. 6 x 9 in. 72 pp.

The various devices designed for protection of the eyes featured by the company, including lenses for every industrial use, helmets, hand and folding shields, goggles, sun glasses and respirators, are described and illustrated in this catalog. In addition, attention is called to other safety products marketed by the company. Attractively printed in two colors, the catalog is virtually a handbook of safety products.

•

**Meehanite — The Metal for Machine Tool Castings.** (Bulletin No. 9). Meehanite Research Institute of America, Inc., 311 Ross St., Pittsburgh, Penna. 8½ x 11 in. 16 pp.

The engineering properties of Meehanite as a metal for machine tool castings are discussed in this booklet. Data is given on rigidity, high yield point, tensile strength, endurance limit, hardness, coefficient of friction, machinability, modulus of rupture, etc. Various properties are graphically described. A number of machines made with Meehanite are illustrated.

•

**Lanolin Woolfat.** Lanaetex Products Sales Corp., P. O. Box 52, Station A, Elizabeth, N. J. 8½ x 11 in. 4 pp.

The recovery of wool fat, method of refining and applications in various industries, including rubber, are discussed in this pamphlet. Wool fat, often called wool grease or neutral degras, finds use in rubber compounding as a dispersing and softening agent, as a compounding ingredient in hard rubber and rubber substitutes, and in the reclaiming of rubber. It is also used in rubber cement manufacture.

•

**Stearns Magnetic Disc Brakes.** (Bulletin No. 604.) Stearns Magnetic Mfg. Co., Milwaukee, Wisc. 8½ x 11 in. 12 pp.

This bulletin contains a comprehensive treatise on the subject of magnetic disc brakes, including descriptions, specifications, formulas and other information of value to users and prospective users of magnetic brakes. Attractively printed in two colors, it includes a number of installation views. Features of the company's equipment are stressed.

## Briefs . . . .

A catalog on its **lubricating oil coolers** (Catalog No. 31), giving specifications and other information, has been issued by the Condenser Service & Engineering Co., 310 Twelfth St., Hoboken, N. J.

•

Bulletin No. ED-7, which describes its full line of **industrial gas masks** with the new all-vision facepiece as standard equipment, is being distributed by the Mine Safety Appliances Co., Braddock, Thomas & Meade Streets, Pittsburgh, Penna.

•

The company's low-voltage metal-enclosed **air circuit breaker switch-gear** is described and illustrated in Catalog 1230, recently issued by the Roller-Smith Co., 1766 West Market St., Bethlehem, Penna.

•

A comprehensive line of **thermocouple assemblies,** with their parts and accessories, is shown in Catalog N-33A(6) of the Leeds & Northrup Co., 4907 Stenton Ave., Philadelphia, Penna. Information on the correct choice of couples is also included.

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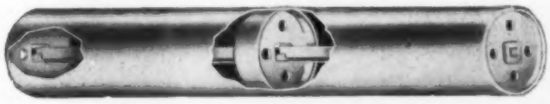

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# MARKETS

***Rubber – Crude, Reclaimed and Scrap – Cotton – Ducks – Tire Fabrics – Sheetings***

**NEW YORK, SEPTEMBER 9, 1940**

## Crude Rubber

THE downward readjustment in spot rubber prices on the Commodity Exchange, which set in during July, continued during August and the early part of September, with still lower prices expected in the immediate future. The price showed a differential of 50 points between the high and the low for the period, high being 19.75 quoted on August 14 and 15, and low 19.25 on August 29. The first heavy drop in a slowly but steadily declining market came on August 29, when the price dropped from 19.43 on the previous trading day to 19.25, low for the period, the sharp drop being occasioned by heavy September liquidation in futures, plus the fact that large stocks are available and reassurance from importers of continuance of supplies. Increase in factory demand, however, brought the price back to 19.50 within a day or two, but announcement of an increase in the quota from 85 to 90% broke it again on September 6 to 19.37. Quotations in the outside market, Exchange, London and Singapore, follow:

As of September 9

***Plantations—***

| | | | |
|---|---|---|---|
| Ribbed Smoked Sheets— | | | |
| No. 1 Spot | — | @ | .19⅜ |
| November | — | @ | .19⅝ |
| January-March | — | @ | .19½ |
| No. 2 | — | @ | .19¾ |
| No. 3 | — | @ | .19⅞ |
| No. 4 | — | @ | .19½ |
| Thin Latex Crepe | — | @ | .19⅜ |
| Thick Latex Crepe | — | @ | .19⅜ |
| Brown Crepe, No. 1 | — | @ | .18 |
| Brown Crepe, No. 2 | — | @ | .17¾ |
| Amber Crepe, No. 2 | — | @ | .18 |
| Amber Crepe, No. 3 | — | @ | .17¾ |
| Brown Crepe, Rolled | — | @ | .14½ |

***Latex—***

| | | | |
|---|---|---|---|
| Normal, per lb., carload lots | — | @ | .24⅛ |

***Paras—***

| | | | |
|---|---|---|---|
| Up-River, fine | — | @ | .18⅞ |
| Acre Bolivian, fine | — | @ | .19 |

***Balata***

| | | | |
|---|---|---|---|
| Brazilian block | — | @ | .14 |

### LONDON MARKET

Standard Smoked Sheets—Buyers—September 9

| | | | |
|---|---|---|---|
| September | 12 5/16 | @ | 12 7/16d |
| January-March | 12 1/4 | @ | 12 3/8d |

### SINGAPORE MARKET

Standard Smoked Sheets—Sellers—September 9

| | | | |
|---|---|---|---|
| October-December | — | @ | 10 3/4d |
| January-March | — | @ | 9 11/16d |

## Scrap Rubber

The scrap rubber market is picking up rapidly, according to dealers, who anticipate a keen demand in the early future based on needs created under the National Defense Program and the swinging of the automotive industry into production on 1941 models. Prices have increased slightly on mixed auto and inner tube stocks since our last report. Current quotations follow:

(Prices to Consumers)

| | | | |
|---|---|---|---|
| Auto tire peelings | ton | 22.00 | @23.00 |
| Mixed auto | ton | 14.00 | @15.00 |
| Beadless tires | ton | 18.00 | @19.00 |
| Clean solid truck tires | ton | 30.00 | @32.50 |
| Boots and shoes | ton | 21.00 | @22.00 |
| Arctics, untrimmed | ton | 18.00 | @19.00 |
| Inner tubes, No. 1 | lb. | .10 | @ .11 |
| Inner tubes, No. 2 | lb. | .04½ | @ .04¾ |
| Inner tubes, Red | lb. | .04½ | @ .04¾ |

## Reclaimed Rubber

Although the reclaim business is not all it might be, reclaimers report a fairly steady demand, with that for August exceeding that for July slightly. An early pick-up is anticipated in view of the early production planned by the automotive industry on 1941 models. Early settlement of the labor difficulties now being experienced by several insulated wire companies is expected to result in a stronger demand from that field. There has been no change in the price structure since our last report. Current quotations follow:

***Shoe***

| | | | |
|---|---|---|---|
| Unwashed | lb. | .06½ @ | .06¾ |
| Washed | lb. | .10 @ | .10¼ |

***Tube***

| | | | |
|---|---|---|---|
| No. 2 (Compounded) | lb. | .09 @ | .10 |
| Red Tube | lb. | .09 @ | .09¼ |

***Tires***

| | | | |
|---|---|---|---|
| Black (acid process) | lb. | .07 @ | .07¼ |
| Black, selected tires | lb. | .06 @ | .06¼ |
| Dark Gray | lb. | .09¼ @ | .10 |
| White | lb. | .12½ @ | .14 |
| Truck, Heavy Gravity | lb. | .05½ @ | .06 |
| Truck, Light Gravity | lb. | .07 @ | .07½ |

***Miscellaneous***

| | | | |
|---|---|---|---|
| Mechanical blends | lb. | .04½ @ | .05 |

## Tire Fabrics

(Prices Net at the Mill)

| | | | |
|---|---|---|---|
| Peeler, carded, 23/5/3 | lb. | .29¼ @ | .29½ |
| Peeler, carded, 23/4/3 | lb. | .30¼ @ | .30½ |
| Peeler, carded, 15/3/3 | lb. | .27¼ @ | .27½ |
| Peeler, carded, 15/4/2 | lb. | .27¼ @ | .27½ |
| Peeler, carded, 13/3/3 | lb. | .26¼ @ | .26½ |

CHAFERS

| | | | |
|---|---|---|---|
| Carded, American, 1 1/16" | lb. | .29¼ @ | .29¾ |
| Carded, American, 1" | lb. | .19¾ @ | .26 |

## Cotton

Cotton prices have swung in a narrow 32 point range since our last report, seesawing from day to day but showing a tendency toward lower levels in the past several days. As is the case with dull markets, unfavorable reports were satisfactorily offset with favorable ones. For instance, the effects of crop damage caused by a hurricane in Louisiana was balanced by reports of improvements in other areas while hedge selling and foreign liquidation were quickly offset by mill price fixing which strengthened the market. The Census Bureau announced in mid-August that the cotton carryover on July 31, the end of the 1939-40 crop year, totaled 10,595,720 bales against 13,032,513 a year ago, a decided improvement. In early September independent sources set this season's cotton crop at 12,580,000 bales, an increase of 1,514,000 bales from the previous independent estimate. Today (September 9), the Crop Reporting Board of the Department of Agriculture set this figure at 12,772,000, or 1,343,000 bales more than its last estimate. Quotations for middling uplands on the Exchange follow:

| | Aug. 9 | September 9 | | |
|---|---|---|---|---|
| | Close | High | Low | Close |
| October | 9.36 | 9.32 | 9.20 | 9.30 |
| December | 9.31 | 9.27 | 9.15 | 9.25 |
| March | 9.11 | 9.08 | 8.96 | 9.07 |

## Sheetings

| | | | | | |
|---|---|---|---|---|---|
| 48x40 | 36 | in. | 5.50 lb. | — @ | .04 |
| 40x40 | 36 | in. | 6.15 lb. | — @ | .03⅝ |
| 40x36 | 36 | in. | 6.50 lb. | — @ | .03½ |
| 48x48 | 40 | in. | 2.50 lb. | — @ | .07⅞ |
| 48x48 | 40 | in. | 2.85 lb. | — @ | .07 |
| 56x60 | 40 | in. | 3.60 lb. | — @ | .06¾ |
| 48x44 | 40 | in. | 3.75 lb. | — @ | .05⅝ |

## Ducks

| | | | |
|---|---|---|---|
| Enameling (single filling) | lb. | .24 @ | .25 |
| Belting and Hose | lb. | .26¾ @ | — |
| Single filling, A grade | lb. | .11 @ | .12 |
| Double filling | lb. | .12 @ | .13 |

### *Closing Rubber Prices on New York Commodity Exchange, Inc.*

*No. 1 Standard Contract of 10 Tons*

FROM AUGUST 10 TO SEPTEMBER 9

| Date | Spot | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | June | July | Sales |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aug. 10 | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | |
| 12 | 19.57 | 19.57 | 19.37 | 19.12 | 19.06 | 19.01 | 18.93 | 18.85 | 18.78 | 18.68 | 18.58 | | | 23 |
| 13 | 19.62 | 19.35 | 19.40 | 19.15 | 19.10 | 19.06 | 18.97 | 18.88 | 18.80 | 18.70 | 18.60 | | | 42 |
| 14 | 19.75 | 19.65 | 19.65 | 19.40 | 19.27 | 19.15 | 19.07 | 19.01 | 18.95 | 18.85 | 18.75 | | | 67 |
| 15 | 19.75 | 19.65 | 19.65 | 19.40 | 19.33 | 19.23 | 19.17 | 19.08 | 19.00 | 18.90 | 18.80 | | | 50 |
| 16 | 19.62 | 19.54 | 19.54 | 19.29 | 19.24 | 19.20 | 19.15 | 19.09 | 19.03 | 18.94 | 18.86 | | | 45 |
| 17 | | | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | | | |
| 19 | 19.62 | 19.52 | 19.52 | 19.27 | 19.21 | 19.15 | 19.05 | 18.95 | 18.85 | 18.76 | 18.68 | | | 39 |
| 20 | 19.62 | 19.55 | 19.54 | 19.29 | 19.24 | 19.20 | 19.11 | 19.02 | 18.93 | 18.84 | 18.76 | | | 62 |
| 21 | 19.62 | 19.50 | 19.50 | 19.25 | 19.20 | 19.15 | 19.07 | 19.00 | 18.93 | 18.84 | 18.76 | | | 64 |
| 22 | 19.57 | 19.44 | 19.44 | 19.34 | 19.25 | 19.16 | 19.07 | 19.00 | 18.93 | 18.84 | 18.76 | | | 83 |
| 23 | 19.57 | 19.42 | 19.42 | 19.31 | 19.25 | 19.20 | 19.13 | 19.05 | 18.98 | 18.93 | 18.88 | | | 233 |
| 24 | | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | | |
| 26 | 19.57 | 19.39 | 19.39 | 19.32 | 19.27 | 19.22 | 19.05 | 19.02 | 19.00 | 18.95 | 18.90 | | | 156 |
| 27 | 19.57 | 19.40 | 19.40 | 19.32 | 19.27 | 19.21 | 19.05 | 19.02 | 19.00 | 18.95 | 18.90 | | | 198 |
| 28 | 19.43 | — | 19.25 | 19.10 | 19.00 | 19.10 | 19.08 | 19.07 | 19.05 | 18.99 | 18.93 | | | 188 |
| 29 | 19.25 | — | 19.07 | 19.05 | 19.05 | 19.12 | 19.09 | 19.07 | 19.05 | 18.98 | 18.92 | | | 236 |
| 30 | 19.31 | — | 19.12 | 19.13 | 19.14 | 19.15 | 19.11 | 19.08 | 19.05 | 18.98 | 18.92 | | | 29 |
| 31 | | | | | | | | | | | | | | |
| Sept. 1 | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | |
| 3 | 19.50 | — | 19.22 | 19.22 | 19.22 | 19.22 | 19.19 | 19.17 | 19.15 | 19.05 | 18.95 | | | 26 |
| 4 | 19.50 | — | 19.28 | 19.27 | 19.26 | 19.25 | 19.23 | 19.21 | 19.19 | 19.14 | 19.10 | | | 59 |
| 5 | 19.50 | — | 19.30 | 19.30 | 19.30 | 19.30 | 19.26 | 19.23 | 19.20 | 19.15 | 19.10 | | | 83 |
| 6 | 19.37 | — | 19.25 | 19.23 | 19.22 | 19.21 | 19.18 | 19.14 | 19.10 | 19.05 | 19.00 | | | 57 |
| 7 | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | |
| 9 | 19.37 | — | 19.18 | 19.18 | 19.18 | 19.18 | 19.15 | 19.13 | 19.11 | 19.07 | 19.03 | | | 23 |

# Stamford Neophax Vulcanized Oil

(REG. U. S. PAT. OFF.)

## For Use With Neoprene

THE STAMFORD RUBBER SUPPLY CO. STAMFORD CONN.

Makers of Stamford Factice Vulcanized Oil Since 1900

STANDARDIZED QUALITY

# LATEX

· NORMAL ·
CONCENTRATED · PROCESSED

Consistent Standardized Uniformity

Concentrates from 50% to 75% solids content for all industrial uses.

Specially processed latex and compounds to meet new and old requirements.

We offer many processed types and formulas suitable for particular applications, and also supply to buyers' own specifications.

Large Stocks Available for Prompt Delivery

Trade Mark

# HEVEATEX CORPORATION

78 GOODYEAR AVE. MELROSE, MASS.

Trade Mark

NEW YORK, N. Y. CHICAGO ILL. AKRON, OHIO LOS ANGELES, CAL.

# ROBERT BADENHOP CORPORATION

•

## CRUDE RUBBER

GUTTA PERCHA
LIQUID LATEX

GUTTA SIAK
BALATA

•

WOOLWORTH BLDG. (TEL. CORTLAND 7-6920) NEW YORK, N.Y.

# CHEMICAL MARKETS

*New York, Sept. 11, 1940*
*All Prices F.O.B. Works*

### ACCELERATORS

| | | | |
|---|---|---|---|
| **Organic** | | | |
| A-1 (Thiocarbanilid) | lb. | .24 @ | .30 |
| A-10 | lb. | .31 @ | .35 |
| A-11 | lb. | .52 @ | .65 |
| A-19 | lb. | .52 @ | .65 |
| A-32 | lb. | .70 @ | .80 |
| A-77 | lb. | .42 @ | .55 |
| A-100 | lb. | .42 @ | .55 |
| Aldehyde ammonia, crystals | lb. | .65 @ | .70 |
| Altax | lb. | .55 @ | .65 |
| Butyl Zimate | lb. | 2.50 @ | — |
| Captax | lb. | .50 @ | .57 |
| Crylene | lb. | .55 @ | .65 |
| Di-Ortho-Tolyguanidine | lb. | .44 @ | .46 |
| Diphenylguanidine | lb. | .35 @ | .36 |
| El-Sixty | lb. | .50 @ | .65 |
| Ethyl Zimate | lb. | 2.50 @ | — |
| Ethylidene aniline | lb. | .42 @ | .43 |
| Formaldehyde aniline | lb. | .37½ @ | .42 |
| Guantal | lb. | .40 @ | .50 |
| Hepteen | lb. | .35 @ | .40 |
| Hexamethylenetetramine | lb. | .33 @ | — |
| Lead Oleate, No. 999 | lb. | .14 @ | — |
| Witco | | .15 @ | — |
| Menex | lb. | — @ | 2.35 |
| Phenex | lb. | .50 @ | .55 |
| Pip-Pip | lb. | 2.50 @ | — |
| Pipoleine | lb. | 1.55 @ | 1.85 |
| R & H 50 D | lb. | .42 @ | .43 |
| R-2 | lb. | 1.40 @ | 1.80 |
| R-2 Crystals | lb. | 2.50 @ | 2.75 |
| R-33 | lb. | .40 @ | — |
| RN-2 | lb. | 1.40 @ | 1.80 |
| RN-2 Crystals | lb. | 2.00 @ | 2.25 |
| Rotax | lb. | .60 @ | .65 |
| Safex | lb. | 1.20 @ | 1.30 |
| SPDX | lb. | .70 @ | .75 |
| Super-Sulphur No. 1 | lb. | .50 @ | — |
| No. 2 | lb. | .18 @ | .25 |
| Thiocarbanilid, drums | lb. | .24 @ | .30 |
| Thiurad | lb. | — @ | 2.35 |
| Trimene | lb. | .55 @ | .65 |
| base | lb. | 1.05 @ | 1.20 |
| Triphenylguanidine | lb. | .45 @ | — |
| Tuads | lb. | 2.35 @ | — |
| Ulto | lb. | 1.50 @ | 1.75 |
| Ureka | lb. | .60 @ | .75 |
| Ureka Blend B | lb. | .60 @ | .75 |
| Ureka C | lb. | .56 @ | .65 |
| Vulcanex | lb. | .42 @ | .43 |
| Vulcanol | lb. | .85 @ | — |
| Zimate | lb. | 2.35 @ | — |
| **Inorganic** | | | |
| Litharge, domestic | lb. | .07 @ | .07½ |
| Magnesia, calcined, heavy | lb. | .04 @ | — |

### COLORS

**Blacks** (See Compounding Materials)

| | | | |
|---|---|---|---|
| **Blues** | | | |
| Prussian | lb. | .36 @ | .37 |
| Ultramarine | lb. | .15 @ | — |
| **Browns** | | | |
| Mapico | lb. | .13 @ | — |
| Umber, Turkey | lb. | .04 @ | .04½ |
| **Greens** | | | |
| Chrome | lb. | .21 @ | — |
| Guignet's Green | lb. | .70 @ | — |
| **Reds** | | | |
| Antimony | | | |
| crimson, 15/17 | lb. | .45 @ | — |
| sulfur, free | lb. | .48 @ | .60 |
| Indian English | lb. | .09 @ | .10 |
| Domestic (Maroon) | lb. | .11 @ | — |
| Red oxide, pure | lb. | .10 @ | .12 |
| Rub-Er-Red, f.o.b. Easton | lb. | .09¼ @ | — |
| **Whites** | | | |
| Cryptone, No. 19 | lb. | .05¼ @ | .05½ |
| Cryptone CB, No. 21 | lb. | .05¼ @ | .05½ |
| Cryptone, ZS-230 | lb. | .07½ @ | .07¾ |
| Cryptone, ZS-86 | lb. | .07½ @ | .07¾ |
| Lithopone | | | |
| Albalith, black label—11 | lb. | .0360 @ | .0385 |
| Azolith | lb. | .0360 @ | .0385 |
| Ray-bar | lb. | .05¼ @ | .05¾ |
| Ray-cal | lb. | .05¼ @ | .05¾ |
| Rayox | lb. | .13 @ | .14 |
| Titanox A | lb. | .13 @ | .14 |
| Titanox B | lb. | .05¼ @ | .05¾ |
| Titanox C | lb. | .05 @ | .05½ |
| **Zinc Oxide—American Process** | | | |
| American Azo: | | | |
| ZZZ (lead free) | lb. | .06¼ @ | .06½ |
| Anaconda, lead free | lb. | .06¼ @ | .06½ |
| Horsehead Lead Free Brand: | | | |
| Special—3 | lb. | .06¼ @ | .06½ |
| XX Red—4 | lb. | .06¼ @ | .06½ |
| XX Red—72 | lb. | .06¼ @ | .06½ |
| XX Red—78 | lb. | .06¼ @ | .06½ |
| XX Red—103 | lb. | .06¼ @ | .06½ |
| Kadox, black label—15 | lb. | .06½ @ | .06¾ |
| Blue label—16 | lb. | .06½ @ | .06¾ |
| Red label—17 | lb. | .06½ @ | .06¾ |
| St. Joe, black label | lb. | .06¼ @ | .06½ |
| green label | lb. | .06¼ @ | .06½ |
| red label | lb. | .06¼ @ | .06½ |
| U. S. P.—7, bbls. | lb. | .09½ @ | .09¾ |
| **Zinc Oxide—French Process** | | | |
| Florence White seal—7 bbls. | lb. | .08½ @ | .08¾ |
| Green seal—8 | lb. | .08 @ | .08¼ |
| Red seal—9 | lb. | .07½ @ | .07¾ |
| **Yellows** | | | |
| Cadmolith | lb. | .55 @ | .65 |
| Chrome | lb. | .14½ @ | .15½ |
| Mapico | lb. | .09½ @ | — |

### BLACKS
(In bags, carload lots)

| | | | |
|---|---|---|---|
| Aerfloted Arrow | lb. | .02925 @ | — |
| Certified | lb. | .02925 @ | — |
| Certified Spheron | lb. | .02925 @ | — |
| Continental | lb. | .02925 @ | — |
| Disperso | lb. | .02925 @ | — |
| Dixiedensed | lb. | .02925 @ | — |
| Dixiedensed 66 | lb. | .02925 @ | — |
| Excello | lb. | .02925 @ | — |
| Fumonex | lb. | .03 @ | — |
| Fumonex Beads | lb. | .03 @ | — |
| Gastex | lb. | .03 @ | — |
| Kosmobile | lb. | .02925 @ | — |
| Kosmobile 66 | lb. | .02925 @ | — |
| Micronex (Amarillo) | lb. | .02925 @ | — |
| Micronex Beads (Amarillo) | lb. | .02925 @ | — |
| Pelletex | lb. | .03 @ | — |
| P-33 | lb. | .0475 @ | — |
| Supreme | lb. | .02925 @ | — |
| Thermax | lb. | .02 @ | — |
| Wyex | lb. | .02925 @ | — |

### COMPOUNDING MATERIALS

| | | | |
|---|---|---|---|
| Aluminum Flake | ton. | 21.85 @ | 24.50 |
| Asbestine | ton | 13.00 @ | 15.00 |
| Barium carbonate (98-100%) | ton | — @ | — |
| Barytes | ton | 21.50 @ | 26.50 |
| Bentonite | lb. | .02 @ | .03 |
| Blanc fixe dry f.o.b. works | ton | 60.00 @ | 65.00 |
| Calcene | ton | 37.50 @ | 45.00 |
| Catalpo (fact.) | lb. | .02 @ | — |
| Chalk, precipitated | | | |
| Suprex white, extra lt. | ton | 45.40 @ | 60.00 |
| heavy | ton | 45.00 @ | 55.00 |
| Clay, Aerfloted, Suprex | ton | 10.00 @ | 22.00 |
| Crown (f.o.b. plant) | ton | 10.00 @ | — |
| Dixie | ton | 10.00 @ | 24.50 |
| Langford | ton | — @ | 8.50 |
| McNamee | ton | 10.00 @ | 22.50 |
| Par | ton | 10.00 @ | 22.50 |
| Witco | ton | 10.00 @ | — |
| Cotton Flock (Dark) | lb. | .10½ @ | .13 |
| Kalite No. 1 | ton | 24.00 @ | 50.00 |
| Kalite No. 3 | ton | 34.00 @ | 60.00 |
| Kalvan | ton | 95.00 @ | 121.00 |
| Magnesium carbonate | lb. | .07½ @ | — |
| Mica | ton | 35.00 @ | 44.00 |
| Mineralite | ton | — @ | 30.00 |
| Pyrax A | ton | 6.00 @ | 20.00 |
| Rottenstone (powdered) | lb. | .02½ @ | .05 |
| Silene (calcium silicate) | lb. | .04 @ | .045 |
| Soapstone, powdered | ton | 16.00 @ | 22.00 |
| Starch, powdered | cwt. | 2.90 @ | 4.10 |
| Talc, domestic | ton | 25.00 @ | 45.00 |
| Whiting, commercial | ton | 17.00 @ | 18.00 |
| Columbia Filler | ton | 9.00 @ | 14.00 |
| English Cliffstone | ton | 33.00 @ | 43.00 |
| Witco | ton | 6.00 @ | — |
| Wood Flour | ton | 20.00 @ | 25.00 |

### MINERAL RUBBER

| | | | |
|---|---|---|---|
| 285°-300° Mineral Rubber | ton | 23.00 @ | 42.00 |
| Black Diamond | ton | 25.00 @ | — |
| Genasco, solid (factory) | ton | 25.00 @ | 27.00 |
| Hard Hydrocarbon | ton | 23.00 @ | 42.00 |
| Parmr, solid | ton | 21.00 @ | 27.00 |
| Pioneer, MR, solid | ton | | |

### MISCELLANEOUS

| | | | |
|---|---|---|---|
| Aromatics—Rodo #0 | lb. | 3.50 @ | 4.00 |
| Rodo #10 | lb. | 4.50 @ | 5.00 |
| Curodex 19 | lb. | 2.75 @ | — |
| Curodex 188 | lb. | 3.50 @ | — |
| Curodex 198 | lb. | 4.50 @ | — |
| Para-Dor No. 5145 | lb. | 2.00 @ | — |
| Aresklene No. 375 (dispersing, wetting and penetrating agent) | lb. | .35 @ | .50 |
| Darvan (dispersing agent) | lb. | .30 @ | .39 |
| Santomerse S (dispersing, wetting, penetrating and stabilizing agent) | lb. | .11 @ | .25 |
| Sunproof | lb. | .22 @ | .27 |
| Sponge Paste | lb. | — @ | .18 |
| Tackol (tackifier) | lb. | .085 @ | .18 |
| Tonox | lb. | .52 @ | .61 |
| Ty-Ply R (and S) | gal. | 6.75 @ | 10.75 |
| Unicel (blowing agent) | lb. | .50 @ | — |

### SOFTENERS

| | | | |
|---|---|---|---|
| **Acids** | | | |
| Acetic, 28%, bbls. | 100 lb. | 2.53 @ | 2.78 |
| Nitric, 36 degrees | cwt. | 5.00 @ | 6.00 |
| Sulfuric, 66 degrees | ton | 13.50 @ | 16.50 |
| **Acids, Fatty** | | | |
| Laurex | lb. | .10½ @ | .12¾ |
| SL #10 | lb. | .12 @ | .14 |
| Stearex Beads | lb. | .08 @ | .09 |
| Stearic, double pressed | lb. | .12½ @ | .13½ |
| Stearite | lb. | .09 @ | — |
| **Alkalies** | | | |
| Caustic Soda, 76% | cwt. | 2.70 @ | 3.55 |
| Soda Ash, 58%, C.L. | cwt. | — @ | 2.35 |
| **Oils** | | | |
| Cycline Oil | gal. | .14 @ | .20 |
| Degras, bbls. | lb. | .07¾ @ | .08 |
| Fluxrite | lb. | .05½ @ | .06½ |
| Para-Flux | gal. | .17 @ | .18 |
| Para-Lube | lb. | .046 @ | .048 |
| Petrolatum, light | lb. | .03½ @ | .03¾ |
| Pigmentaroil, tank cars | gal. | .16 @ | — |
| in drums | gal. | .22½ @ | .23½ |
| Pine, steam distilled | gal. | .64 @ | .69 |
| Rosin Oil, cmpd. | gal. | .40 @ | — |
| Rubberol, f.o.b. Chicago | lb. | .13½ @ | .14 |
| Rubtack | lb. | .08 @ | .10 |
| Seedine, c.l. | lb. | .07½ @ | — |
| Tackol | lb. | .08½ @ | .18 |
| Witco Palm Oil | lb. | .07 @ | — |
| Witco Softener No. 20 | gal. | .20 @ | — |
| Woburn No. 8, c.l. | lb. | .06 @ | — |
| **Resins and Pitches** | | | |
| Pitch, Burgundy | lb. | .05½ @ | .06½ |
| coal tar | ton | 19.00 @ | 22.00 |
| hardwood | ton | 16.00 @ | 22.50 |
| pine, 200 lb. gr. wt. | bbl. | 6.00 @ | 6.50 |
| Pigmentar, tank cars | gal. | .16 @ | — |
| in drums | gal. | .22½ @ | .23½ |
| R. S. L. Resin | lb. | — @ | — |
| Retort Pine Tar, drums | ton | 20.00 @ | 26.00 |
| **Solvents** | | | |
| Acetone, pure | lb. | — @ | — |
| Benzene, 90% | gal. | .18 @ | .23 |
| Beta-Trichlorethane | gal. | — @ | .20 |
| Bondogen | lb. | .98 @ | 1.50 |
| Carbon, bisulfide | lb. | .05¼ @ | .08 |
| Carbon tetrachloride | gal. | .73 @ | 1.065 |
| Dichlorethylene | lb. | — @ | — |
| Dipentene, cml., drums | gal. | .41 @ | .50 |
| Ethylene dichloride | lb. | .06 @ | .07 |
| Plastogen | lb. | .07¼ @ | .12 |
| Reogen (drums) | lb. | .11½ @ | .26 |
| Rub-Sol (f.o.b. Okla.) | gal. | .09 @ | — |
| Trichlorethylene | lb. | — @ | .08½ |
| Turpentine, spirits | gal. | .43 @ | .47 |
| dest. dist., drums | gal. | .33 @ | .41 |
| **Waxes** | | | |
| Beeswax, white | lb. | .39 @ | .45 |
| Carnauba, yellow | lb. | .46 @ | .47½ |
| Ceresin, white, dom. | lb. | .08 @ | .11 |
| Montan, crude | lb. | .10¾ @ | .11¾ |
| **Paraffin (c.l.—f.o.b. N. Y.)** | | | |
| Yellow crude scale | lb. | .02¾ @ | — |
| Refined, 122/127 | lb. | .04½ @ | — |

### ANTI-OXIDANTS

| | | | |
|---|---|---|---|
| Agerite Alba | lb. | 1.50 @ | 1.95 |
| Exel | lb. | 1.00 @ | 1.40 |
| Gel | lb. | .57 @ | .73 |
| Hipar | lb. | .65 @ | .92 |
| Powder | lb. | .52 @ | .64 |
| Resin | lb. | .52 @ | .64 |
| Resin D | lb. | .52 @ | .64 |
| White | lb. | 1.25 @ | 1.60 |
| Albasan | lb. | .70 @ | .75 |
| Antox | lb. | — @ | .56 |
| B-L-E | lb. | .52 @ | .61 |
| Flectol B | lb. | .52 @ | .65 |
| Flectol H | lb. | .52 @ | .65 |
| Flectol White | lb. | .90 @ | 1.15 |
| Neozone | lb. | .52 @ | .63 |
| Oxynone | lb. | .64 @ | .80 |
| Retardex | lb. | .35 @ | .40 |
| Santoflex B | lb. | .52 @ | .65 |
| Santovar A | lb. | 1.15 @ | 1.40 |
| S.C.R. | lb. | .33 @ | .35 |
| Stabilite | lb. | .52 @ | .54 |
| Stabilite Alba | lb. | .70 @ | .75 |
| VGB | lb. | .52 @ | .61 |

### MOLD LUBRICANTS

| | | | |
|---|---|---|---|
| Aresklene | lb. | .35 @ | .50 |
| Cocoa Soapstock | lb. | .06 @ | .08 |
| Dipex | lb. | .06 @ | .08 |
| Lubrex | lb. | .25 @ | .36 |
| Mineralite | ton | — @ | 30.00 |
| Mold Paste | lb. | .12 @ | .18 |
| Rubberol, f.o.b. Chicago | lb. | .13½ @ | .14 |
| Sericite, f.o.b. N. Y. | ton | 65.00 @ | — |
| Soap Tree Bark, cut, sifted | lb. | .06 @ | .08 |

### FACTICE OR RUBBER SUBSTITUTES

| | | | |
|---|---|---|---|
| Amberex | lb. | .25 @ | — |
| Amberex Type B | lb. | .17¾ @ | — |
| Black | lb. | .08 @ | .12 |
| White | lb. | .08½ @ | .12 |
| Brown | lb. | .08 @ | .10½ |
| Neophax | lb. | .09¾ @ | — |

### VULCANIZING INGREDIENTS

| | | | |
|---|---|---|---|
| Dispersed Sulfur No. 2 | lb. | .07½ @ | .15 |
| Sulfur Chloride, yellow (drs.) | lb. | .035 @ | .04 |
| Sulfur flour, | | | |
| Refined, 100% pure (bags) | cwt. | 2.50 @ | 3.65 |
| Commercial (bags) | cwt. | 1.60 @ | 2.35 |
| Telloy | lb. | 1.75 @ | — |
| Vandex | lb. | 1.75 @ | — |

# STATISTICS

***Crude Rubber — Latex & Guayule — Reclaim — Tires & Tubes — Automobiles — Rims — Gasoline — Cotton Prices***

## U. S. Imports and Exports of Crude Rubber

| YEARS | Gross Imports: Long Tons | Gross Imports: Total Declared Value | Gross Imports: Average Declared Value per pound Cents | Re-exports: Long Tons | Re-exports: Total Declared Value | Re-exports: Average Declared Value per pound Cents | Net Imports: Long Tons |
|---|---|---|---|---|---|---|---|
| 1924 | 325,899 | 173,367,272 | 23.75 | 10,309 | 6,057,637 | 26.23 | 315,590 |
| 1925 | 393,370 | 426,167,504 | 48.36 | 14,827 | 19,847,753 | 59.76 | 378,543 |
| 1926 | 409,944 | 501,131,064 | 54.57 | 17,671 | 22,470,583 | 56.77 | 392,273 |
| 1927 | 424,733 | 338,688,492 | 35.60 | 27,775 | 24,735,488 | 39.76 | 396,958 |
| 1928 | 432,633 | 242,727,423 | 25.05 | 32,159 | 18,128,761 | 25.17 | 400,474 |
| 1929 | 560,082 | 239,177,811 | 19.06 | 36,485 | 16,868,718 | 20.64 | 523,597 |
| 1930 | 482,083 | 139,133,048 | 12.88 | 30,205 | 9,310,205 | 13.76 | 451,878 |
| 1931 | 497,176 | 72,922,845 | 6.55 | 25,595 | 4,255,572 | 7.42 | 471,581 |
| 1932 | 409,556 | 31,936,459 | 3.48 | 20,930 | 2,015,612 | 4.30 | 388,626 |
| 1933 | 407,817 | 44,034,064 | 4.82 | 20,537 | 2,601,352 | 5.65 | 387,280 |
| 1934 | 449,513 | 97,929,676 | 9.73 | 23,848 | 5,770,109 | 10.80 | 425,665 |
| 1935 | 453,134 | 115,299,448 | 11.36 | 11,389 | 3,084,331 | 12.09 | 441,745 |
| 1936 | 467,064 | 152,072,496 | 14.54 | 12,581 | 4,488,223 | 15.93 | 454,483 |
| 1937 | 574,600 | 237,307,041 | 18.44 | 7,902 | 3,385,433 | 19.02 | 566,698 |
| 1938 | 397,620 | 125,357,730 | 14.07 | 5,652 | 1,799,124 | 14.21 | 391,968 |
| 1939 | 469,803 | 167,558,245 | 15.92 | 13,125 | 5,832,618 | 19.84 | 456,678 |
| 1939: | | | | | | | |
| June | 32,437 | 11,403,150 | 15.69 | 413 | 147,910 | 16.00 | 32,024 |
| July | 34,288 | 12,071,105 | 15.72 | 440 | 164,428 | 16.69 | 33,848 |
| Aug. | 35,794 | 12,702,958 | 15.84 | 267 | 89,741 | 15.01 | 35,527 |
| Sept. | 35,006 | 12,667,740 | 16.16 | 1,472 | 659,055 | 19.98 | 33,534 |
| Oct. | 42,784 | 15,211,621 | 15.87 | 5,886 | 2,881,172 | 21.85 | 36,898 |
| Nov. | 39,422 | 14,555,150 | 16.48 | 1,228 | 539,763 | 19.63 | 38,194 |
| Dec. | 68,384 | 25,861,354 | 16.88 | 1,116 | 529,759 | 21.20 | 67,268 |
| 1940: | | | | | | | |
| Jan. | 68,962 | 26,314,500 | 17.03 | 955 | 447,673 | 20.92 | 68,007 |
| Feb. | 40,603 | 15,578,517 | 17.13 | 1,291 | 599,819 | 20.74 | 39,312 |
| Mar. | 55,517 | 21,845,290 | 17.57 | 975 | 447,460 | 20.49 | 54,542 |
| April | 66,622 | 26,176,442 | 17.54 | 565 | 252,638 | 19.98 | 66,057 |
| May | 47,559 | 18,511,955 | 17.38 | 821 | 301,914 | 16.41 | 46,738 |
| June | 51,074 | 20,019,581 | 17.50 | 623 | 295,334 | 21.15 | 50,451 |
| July | 66,931 | 26,426,632 | 17.63 | 100 | 49,828 | 22.20 | 66,831 |

Note: "Gross Imports" do not include latex or guayule. To secure more accurate figures for "Net Imports" latex and guayule figures (shown below) should be added and the re-export figure deducted from the total. Annual figures for 1922, however, include both latex and guayule; guayule only is included in 1923. Annual figures for 1922-36 were revised in February, 1937.

## United States Imports of Guayule, Balata, Jelutong, Liquid Latex

*(All Quantities in Long Tons)*

| | Guayule Tons | Guayule Dollars | Balata Tons | Balata Dollars | Jelutong Tons | Jelutong Dollars | Liquid Latex (1) Tons | Liquid Latex (1) Dollars |
|---|---|---|---|---|---|---|---|---|
| 1924 | 1,356 | 536,392 | 464 | 568,456 | 6,165 | 1,237,100 | 2,157 | 864,059 |
| 1925 | 3,781 | 1,803,448 | 517 | 574,750 | 6,749 | 1,642,531 | 3,272 | 3,537,510 |
| 1926 | 4,305 | 2,562,096 | 354 | 327,213 | 7,263 | 3,127,757 | 3,394 | 4,686,743 |
| 1927 | 5,018 | 2,674,957 | 582 | 477,246 | 7,785 | 2,448,657 | 1,495 | 1,170,650 |
| 1928 | 3,077 | 1,755,685 | 731 | 430,855 | 7,552 | 2,540,059 | 4,007 | 2,121,786 |
| 1929 | 1,275 | 545,175 | 728 | 566,964 | 8,204 | 2,458,126 | 3,729 | 1,788,391 |
| 1930 | 1,096 | 347,388 | 502 | 422,684 | 5,907 | 1,403,244 | 4,458 | 1,508,786 |
| 1931 | .... | ..... | 1,207 | 411,380 | 5,777 | 1,019,010 | 4,675 | 888,909 |
| 1932 | .... | ..... | 707 | 147,403 | 4,607 | 616,596 | 5,112 | 601,999 |
| 1933 | .... | ..... | 1,659 | 2,261,869 | 5,990 | 944,895 | 11,085 | 1,833,671 |
| 1934 | 398 | 75,349 | 1,054 | 438,209 | 4,987 | 943,752 | 13,107 | 3,643,221 |
| 1935 | 459 | 86,835 | 615 | 188,384 | 5,644 | 1,063,126 | 13,553 | 3,782,222 |
| 1936 | 1,229 | 286,552 | 535 | 199,368 | 6,163 | 1,296,364 | 19,852 | 6,659,899 |
| 1937 | 2,694 | 745,873 | 354 | 151,344 | 7,109 | 2,017,786 | 23,185 | 10,213,670 |
| 1938 | 2,485 | 623,819 | 509 | 181,140 | 9,132 | 2,944,504 | 11,878 | 4,147,318 |
| 1939 | 2,232 | 463,345 | 694 | 265,553 | 6,640 | 1,603,418 | 27,438 | 10,467,552 |
| 1939: | | | | | | | | |
| June | 91 | 19,879 | 119 | 33,876 | 597 | 122,087 | 1,836 | 694,863 |
| July | 150 | 32,626 | 39 | 18,813 | 663 | 141,540 | 2,934 | 1,064,927 |
| Aug. | 178 | 38,687 | 28 | 8,689 | 742 | 208,156 | 2,614 | 1,001,013 |
| Sept. | 133 | 30,091 | 36 | 19,682 | 479 | 100,285 | 2,525 | 965,615 |
| Oct. | 282 | 61,376 | 107 | 43,267 | 465 | 127,084 | 2,555 | 968,207 |
| Nov. | 214 | 46,558 | 96 | 37,858 | 289 | 74,358 | 3,071 | 1,227,788 |
| Dec. | 236 | 51,521 | 64 | 38,781 | 477 | 126,548 | 2,779 | 1,127,924 |
| 1940: | | | | | | | | |
| Jan. | 128 | 27,901 | 34 | 19,478 | 612 | 155,570 | 3,410 | 1,412,728 |
| Feb. | 314 | 70,251 | 55 | 26,420 | 461 | 134,878 | 2,171 | 947,524 |
| Mar. | 365 | 81,181 | 45 | 20,895 | 542 | 162,493 | 3,376 | 1,473,056 |
| April | 314 | 65,313 | 50 | 18,289 | 506 | 176,064 | 3,763 | 1,608,156 |
| May | 289 | 57,578 | 60 | 20,503 | 495 | 158,713 | 3,584 | 1,523,879 |
| June | 365 | 74,957 | 47 | 10,977 | 390 | 146,196 | 2,451 | 1,004,007 |
| July | 262 | 53,058 | 65 | 20,553 | 336 | 115,599 | 2,281 | 993,411 |

(1) Weight given in pounds of dry rubber contained in latex.
Note: Annual figures for 1924-1936 revised on basis of information received on February 8, 1937.

## U. S. Consumption of Crude Rubber

(Including Latex)

**Figures on Monthly Basis**

| | 1933 | 1934 | 1935 | 1936 | 1937 | 1938 | 1939 | 1940 |
|---|---|---|---|---|---|---|---|---|
| Jan. | 22,645 | 39,190 | 46,636 | 48,631 | 50,879 | 31,265 | 47,387 | 54,978 |
| Feb. | 21,392 | 40,515 | 42,720 | 36,841 | 51,950 | 25,357 | 43,422 | 49,832 |
| Mar. | 17,843 | 47,003 | 42,153 | 42,813 | 54,129 | 32,389 | 51,416 | 50,192 |
| Apr. | 25,928 | 44,853 | 44,247 | 52,031 | 51,859 | 29,730 | 45,268 | 50,103 |
| May | 44,074 | 42,918 | 41,101 | 50,612 | 51,795 | 30,753 | 45,484 | 51,619 |
| June | 50,743 | 40,147 | 36,156 | 52,772 | 51,860 | 32,540 | 48,438 | 46,506 |
| July | 49,614 | 32,553 | 35,917 | 48,250 | 43,703 | 34,219 | 44,975 | 47,011 |
| Aug. | 44,428 | 33,216 | 38,775 | 46,777 | 41,506 | 40,552 | 51,740 | ..... |
| Sept. | 35,281 | 30,258 | 37,086 | 46,449 | 43,945 | 40,183 | 51,402 | ..... |
| Oct. | 31,543 | 31,253 | 41,969 | 49,637 | 38,754 | 42,850 | 57,155 | ..... |
| Nov. | 28,831 | 34,748 | 42,310 | 50,433 | 34,025 | 49,050 | 55,677 | ..... |
| Dec. | 28,757 | 36,569 | 42,474 | 49,754 | 29,195 | 48,143 | 49,636 | ..... |
| Tot. | 401,079 | 453,223 | 491,544 | 575,000 | 543,600 | 437,031 | 592,000 | ..... |

Note: The above figures are based on the annual surveys conducted by the Leather and Rubber Division, Bureau of Foreign & Domestic Commerce, Washington, D. C., with the exception of those for the current year which are estimates made by the Rubber Manufacturers Association. They are revised frequently and the latest available issue should always be consulted for the most reliable figures.

## Reclaimed Rubber in the United States

*(All Quantities in Long Tons)*

| Year | Production | Consumption Tons | Consumption % to Crude | Stocks | Year | Production | Consumption Tons | Consumption % to Crude | Stocks |
|---|---|---|---|---|---|---|---|---|---|
| 1930 | 157,968 | 153,500 | 40.9 | 22,000 | 1935 | 122,948 | 117,523 | 23.9 | 17,000 |
| 1931 | 129,690 | 123,000 | 35.1 | 21,714 | 1936 | 150,571 | 141,486 | 24.6 | 19,000 |
| 1932 | 75,656 | 77,500 | 23.3 | 16,334 | 1937 | 185,033 | 162,000 | 29.8 | 28,800 |
| 1933 | 93,587 | 85,000 | 21.2 | 17,780 | 1938 | 122,400 | 120,800 | 29.9 | 23,000 |
| 1934 | 108,162 | 100,855 | 22.3 | 20,000 | 1939 | 186,000 | 170,000 | 28.7 | 25,250 |

**Figures on Monthly Basis**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1939 | | | | | | | | | |
| Jan. | 13,870 | 12,633 | 26.7 | 22,350 | July | 11,777 | 12,448 | 27.7 | 21,269 |
| Feb. | 13,193 | 12,269 | 28.3 | 22,644 | Aug. | 16,461 | 15,485 | 29.9 | 21,402 |
| Mar. | 14,638 | 14,888 | 29.0 | 21,638 | Sep. | 16,830 | 15,583 | 30.3 | 21,384 |
| Apr. | 13,591 | 12,309 | 27.2 | 22,172 | Oct. | 19,549 | 17,423 | 30.5 | 21,694 |
| May | 13,817 | 12,425 | 27.3 | 22,556 | Nov. | 19,417 | 16,551 | 29.7 | 23,239 |
| June | 14,848 | 13,669 | 28.2 | 22,976 | Dec. | 18,009 | 14,317 | 28.8 | 25,250 |
| 1940: | | | | | | | | | |
| Jan. | 19,297 | 16,070 | 29.2 | 27,418 | July | 14,342 | 14,298 | 30.4 | 28,058 |
| Feb. | 17,992 | 15,370 | 30.8 | 28,603 | Aug. | ..... | ..... | ... | ..... |
| Mar. | 17,234 | 15,931 | 31.7 | 28,488 | Sep. | ..... | ..... | ... | ..... |
| Apr. | 16,568 | 16,298 | 32.5 | 27,558 | Oct. | ..... | ..... | ... | ..... |
| May | 17,552 | 15,719 | 30.5 | 28,397 | Nov. | ..... | ..... | ... | ..... |
| June | 16,631 | 15,844 | 34.1 | 28,327 | Dec. | ..... | ..... | ... | ..... |

Note: The above figures are based on the annual surveys conducted by the Leather and Rubber Division, Bureau of Foreign & Domestic Commerce, Washington, D. C., with the exception of those for the current year which are estimates made by the Rubber Manufacturers Association. They are revised frequently and the latest available issue should always be consulted for the most reliable figures. The annual figures are more accurate. Stocks shown are those on hand at the end of the indicated month or year.

## U. S. Consumption of Gasoline

*(Bureau of Mines Statistics)*
*(In Thousands of Barrels of 42 Gallons)*

| | 1938 | 1939 | 1940 | | 1938 | 1939 | 1940 |
|---|---|---|---|---|---|---|---|
| January | 35,323 | 37,767* | 40,370 | August | 50,549 | 53,828* | ..... |
| February | 31,981 | 34,595 | 37,557 | September | 46,150 | 49,347 | ..... |
| March | 41,409 | 42,520 | 44,607 | October | 46,365 | 49,687 | ..... |
| April | 43,430 | 43,977 | 47,683 | November | 45,084 | 47,275 | ..... |
| May | 44,937 | 49,547 | 52,946 | December | 41,742 | 43,694 | ..... |
| June | 48,383 | 49,812 | 55,459 | | | | |
| July | 47,650 | 50,508 | 53,865 | Total | 523,003 | 552,557* | ..... |

* Revised.

## Rims Inspected and Passed in U. S.

*(Tire and Rim Association Reports)*

| | Total | | Total | | Total |
|---|---|---|---|---|---|
| 1928 ..... | 24,247,282 | 1932 ..... | 6,261,336 | 1936 ..... | 20,790,192 |
| 1929 ..... | 24,141,502 | 1933 ..... | 8,713,962 | 1937 ..... | 22,257,964 |
| 1930 ..... | 17,364,096 | 1934 ..... | 12,255,118 | 1938 ..... | 10,612,138 |
| 1931 ..... | 11,253,800 | 1935 ..... | 18,664,107 | 1939 ..... | 17,471,914 |

| 1940 | | 1940 | | 1940 | |
|---|---|---|---|---|---|
| January ... | 2,163,914 | May ..... | 1,743,786 | September .. | ..... |
| February .. | 1,850,383 | June ..... | 1,266,300 | October ... | ..... |
| March ..... | 1,918,241 | July ..... | 825,089 | November .. | ..... |
| April ..... | 1,822,686 | August .... | ..... | December .. | ..... .. |

## Daily Spot Closing Prices of Ribbed Smoked Sheet Rubber—*New York Market, in Cents per Pound*

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | Ave. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1938 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| June | 11⅜ | 11⅞ | 11¾ | —— | 11½ | 11½ | 11½ | 11⅜ | 12⅛ | 12 | —— | —— | 11⅛ | 12 | 12⅛ | 12⅛ | 12¾ | 13 | —— | 13⅛ | 12⅞ | 13¼ | 13⅞ | 13⅞ | —— | —— | 14⅜ | 13⅞ | 14⅛ | 14⅛ | —— | 12⅞ |
| July | 13¾ | —— | —— | —— | —— | 13⅞ | —— | 15⅜ | —— | —— | 14⅜ | 15⅛ | 15⅞ | 14⅞ | 13⅞ | 13⅞ | 12⅜ | 13⅛ | 15⅞ | 13⅞ | 13⅞ | 13⅞ | —— | 15⅜ | 15⅞ | 15⅜ | 16¼ | 16¼ | 15⅞ | 16⅛ | —— | 15⅜ |
| August | 15⅛ | 15⅛ | 15⅛ | 15⅛ | —— | —— | —— | 16⅛ | 16⅛ | —— | 15⅛ | —— | —— | —— | —— | —— | —— | —— | —— | —— | —— | —— | —— | —— | —— | —— | —— | —— | —— | —— | —— | —— |
| Sept. | 16⅛ | 16⅛ | 16 | 16 | 16 | 16⅛ | 16⅛ | 17⅛ | 17⅛ | 17⅜ | 17⅜ | 16½ | 16⅛ | 16¾ | 17⅛ | 16⅝ | —— | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ |
| Oct. | 16⅛ | —— | 16⅛ | 16¾ | 17 | 16⅞ | 17⅛ | 17⅛ | 17⅛ | 17⅛ | —— | —— | 16⅛ | 17 | 17⅛ | 16⅝ | —— | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ | 16⅝ |
| Nov. | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | —— | —— | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ |
| Dec. | 15⅝ | 15⅛ | 15⅜ | 15⅛ | 15⅛ | 15⅝ | 16⅛ | 15⅝ | 15⅛ | 16 | —— | —— | 15⅛ | 16 | 16 | 16 | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16½ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16 |
| 1939 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Jan. | —— | 15⅝ | 16⅛ | 16⅛ | 16 | 16 | 16 | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅝ | 15⅛ | 15⅝ | —— | 16⅛ | 15⅝ | 15⅝ | 15⅛ | 15⅝ | 15⅝ | 15⅝ | 15⅝ | 15⅝ | 15⅝ | 15⅝ | 15⅝ | 15⅝ | 15⅝ | 15⅝ | 15⅝ | 15⅝ |
| Feb. | —— | 15⅝ | 13⅜ | 15⅛ | —— | —— | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅝ | —— | 15⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | —— | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | —— | —— | —— | —— | —— | —— | —— | —— |
| March | 16⅛ | 16⅛ | 16⅛ | 16⅛ | —— | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 15⅛ | 16⅛ | 16⅛ | 16⅛ | 16 | 16 | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ |
| April | 15⅜ | 15⅛ | 16 | 15⅛ | 16 | 16⅛ | 16⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ | 15⅛ |
| May | 15⅛ | 15⅛ | 16 | 15⅛ | 16 | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 15⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ |
| June | 15⅛ | 15⅛ | 16 | 15⅛ | 16 | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 15⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ |
| July | —— | 16⅛ | 16⅛ | —— | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ |
| August | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ |
| September | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ |
| October | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ | 16⅛ |
| November | 20⅛ | 20⅛ | 19½ | 19½ | 19½ | 20½ | 20½ | 20⅛ | 20⅛ | 20½ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ |
| December | 20 | 20 | 20¼ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 20 | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ |
| 1940 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| January | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 18⅞ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ | 19⅛ |
| February | 18¾ | 18¾ | 18¾ | 18½ | 18¾ | 18¾ | 18¾ | 18⅛ | 18⅛ | 19¼ | 19¼ | 19¼ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ |
| March | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ |
| April | 18⅛ | 18⅛ | 18½ | 18½ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅛ | 18⅞ | 18⅞ | 18⅞ | 18⅞ | 19 | 20⅛ | 20⅛ | 20 | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ |
| May | 19⅛ | 19⅛ | 20 | 21½ | 21½ | 21½ | 21½ | 20 | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ |
| June | 22 | 21½ | 21½ | 21½ | 21½ | 21½ | 21½ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ | 21⅛ |
| July | 21⅛ | 21½ | 20½ | —— | 20½ | 20½ | 20½ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ | 20⅛ |
| August | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ | 19⅞ |
| September | —— | —— | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ | 19⅜ |

## Average Spot Closing Prices—Ribbed Smoked Sheets

*(New York Markets)*

### Average Price per Pound for Years 1913-1932

| Year | Cents | Year | Cents | Year | Cents | Year | Cents | Year | Cents |
|---|---|---|---|---|---|---|---|---|---|
| 1913 | 82.04 | 1917 | 72.23 | 1921 | 16.36 | 1925 | 72.46 | 1929 | 20.59 |
| 1914 | 65.33 | 1918 | 60.15 | 1922 | 17.50 | 1926 | 48.50 | 1930 | 11.98 |
| 1915 | 65.85 | 1919 | 48.70 | 1923 | 29.45 | 1927 | 37.72 | 1931 | 6.17 |
| 1916 | 72.50 | 1920 | 36.30 | 1924 | 26.20 | 1928 | 22.48 | 1932 | 3.49 |

### Average Monthly Price per Pound Since 1933

| | 1933 Cents | 1934 Cents | 1935 Cents | 1936 Cents | 1937 Cents | 1938 Cents | 1939 Cents | 1940 Cents |
|---|---|---|---|---|---|---|---|---|
| Jan. | 3.08 | 9.32 | 13.10 | 14.35 | 21.37 | 14.63 | 15.75 | 19.06 |
| Feb. | 2.95 | 10.45 | 12.92 | 15.48 | 21.33 | 14.71 | 15.93 | 18.83 |
| Mar. | 3.01 | 11.01 | 11.51 | 15.89 | 24.09 | 13.55 | 16.26 | 18.58 |
| Apr. | 3.56 | 12.10 | 11.55 | 15.98 | 23.44 | 11.84 | 15.87 | 19.16 |
| May | 4.95 | 13.26 | 12.05 | 15.62 | 21.14 | 11.57 | 16.07 | 21.21 |
| June | 6.15 | 13.51 | 12.57 | 15.85 | 19.29 | 12.57 | 16.37 | 22.20 |
| July | 8.01 | 14.60 | 12.10 | 16.49 | 18.86 | 15.37 | 16.51 | 21.12 |
| Aug. | 7.31 | 15.47 | 11.98 | 16.25 | 18.37 | 16.08 | 16.67 | 19.62 |
| Sept. | 7.30 | 15.36 | 11.55 | 16.46 | 18.55 | 16.15 | 21.24 | |
| Oct. | 7.64 | 13.96 | 12.62 | 16.55 | 16.28 | 16.89 | 19.89 | |
| Nov. | 8.66 | 13.04 | 13.15 | 17.97 | 14.60 | 16.24 | 20.21 | |
| Dec. | 8.87 | 12.98 | 13.28 | 20.01 | 15.41 | 16.05 | 20.01 | |
| Average for Year | 5.96 | 12.92 | 12.37 | 16.41 | 19.39 | 14.64 | 17.57 | |

## London Closing Prices of Ribbed Smoked Sheets

*(In Pence Per Pound)*

| Day | 1940 June | 1940 July | 1940 Aug. | 1940 Sept. | Day | 1940 June | 1940 July | 1940 Aug. | 1940 Sept. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | —— | 12⅞ | 13 | —— | 17 | 14¼ | 12 1/16 | —— | |
| 2 | —— | 13 | 12 13/16 | 12 5/8 | 18 | —— | 12 1/16 | —— | |
| 3 | 12 1/16 | 12⅞ | —— | 12 | 19 | —— | 12⅝ | 13 | |
| 4 | 12⅛ | 12½ | —— | 12 3/16 | 20 | —— | —— | 12 13/16 | |
| 5 | 12¼ | 12½ | 12 13/16 | 12⅝ | 21 | —— | —— | 12¾ | |
| 6 | 12¼ | —— | 13 1/16 | 12⅞ | 22 | —— | 12 3/16 | 12⅝ | |
| 7 | 12⅜ | —— | 13⅛ | —— | 23 | —— | 12¼ | 12⅝ | |
| 8 | —— | 12½ | 13 | —— | 24 | —— | 12 5/16 | —— | |
| 9 | —— | 12½ | 13 | 12 1/16 | 25 | —— | 12 5/16 | —— | |
| 10 | 12⅝ | 12½ | —— | —— | 26 | —— | 12⅜ | 12⅝ | |
| 11 | 13⅛ | 12½ | —— | —— | 27 | —— | —— | 12½ | |
| 12 | 13⅝ | 12¼ | 13 1/16 | —— | 28 | —— | —— | 12¼ | |
| 13 | 13⅞ | —— | 13⅛ | —— | 29 | —— | 12⅞ | 12¼ | |
| 14 | 13⅛ | —— | 13 3/16 | —— | 30 | —— | 12⅝ | 12⅜ | |
| 15 | —— | 12 | 13 | —— | 31 | —— | 12⅞ | —— | |
| 16 | —— | 11⅞ | 13 | —— | | | | | |

### Average Monthly Price Per Pound

| Month | 1937 Pence | 1938 Pence | 1939 Pence | 1940 Pence | Month | 1937 Pence | 1938 Pence | 1939 Pence | 1940 Pence |
|---|---|---|---|---|---|---|---|---|---|
| Jan. | 10.378 | 7.077 | 7.926 | 11.793 | Aug. | 8.830 | 7.841 | 8.545 | 12.818 |
| Feb. | 10.503 | 7.029 | 7.942 | 12.577 | Sept. | 8.935 | 7.918 | 9.634 | |
| Mar. | 11.766 | 6.590 | 8.120 | 11.651 | Oct. | 7.855 | 8.355 | 10.177 | |
| Apr. | 11.471 | 5.793 | 7.910 | 10.980 | Nov. | 7.080 | 8.111 | 11.210 | |
| May | 10.250 | 5.632 | 8.002 | 11.600 | Dec. | 7.332 | 8.005 | 11.559 | |
| June | 9.548 | 6.147 | 8.216 | 13.046 | Average for Year. | 9.424 | 7.164 | 8.959 | |
| July | 9.136 | 7.464 | 8.271 | 12.410 | | | | | |

Note: No quotations were made in the London market from June 17 through June 30. Accordingly, the average for the month is based on the first eleven trading days only.

## Spot Closing Cotton Prices

*(Middling Upland Grade—New York Market)*

### Recent Daily Price Per Pound

| Date | 1940 July | 1940 Aug. | 1940 Sept. | Date | 1940 July | 1940 Aug. | 1940 Sept. | Date | 1940 July | 1940 Aug. | 1940 Sept. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 10.69 | 10.17 | —— | 11 | 10.58 | —— | | 22 | 10.24 | 9.74 | |
| 2 | 10.63 | 10.18 | —— | 12 | 10.50 | 9.89 | | 23 | 10.23 | 9.66 | |
| 3 | 10.70 | 10.16 | 9.78 | 13 | 10.48 | 9.84 | | 24 | 10.33 | 9.69 | |
| 4 | —— | —— | 9.79 | 14 | —— | 9.77 | | 25 | 10.28 | —— | |
| 5 | 10.46 | 10.11 | 9.78 | 15 | 10.50 | 9.81 | | 26 | 10.23 | 9.70 | |
| 6 | 10.71 | 10.06 | 9.72 | 16 | 10.56 | 9.72 | | 27 | 10.19 | 9.65 | |
| 7 | —— | 10.02 | 9.57 | 17 | 10.43 | 9.71 | | 28 | —— | 9.69 | |
| 8 | 10.60 | 10.08 | —— | 18 | 10.31 | —— | | 29 | 10.16 | 9.69 | |
| 9 | 10.48 | 9.98 | 9.64 | 19 | 10.29 | 9.69 | | 30 | 10.20 | 9.73 | |
| 10 | 10.58 | 9.87 | | 20 | 10.26 | 9.78 | | 31 | 10.19 | 9.71 | |
| | | | | 21 | —— | 9.78 | | | | | |

### Average Monthly Price Per Pound

| | 1937 Cents | 1938 Cents | 1939 Cents | 1940 Cents | | 1937 Cents | 1938 Cents | 1939 Cents | 1940 Cents |
|---|---|---|---|---|---|---|---|---|---|
| Jan. | 13.06 | 8.57 | 8.94 | 11.19 | Aug. | 10.41 | 8.41 | 9.30 | 9.84 |
| Feb. | 13.15 | 8.91 | 8.97 | 11.10 | Sept. | 9.02 | 8.17 | 9.30 | |
| Mar. | 14.46 | 8.92 | 9.00 | 10.90 | Oct. | 8.42 | 8.61 | 9.24 | |
| Apr. | 14.23 | 8.76 | 8.87 | 10.89 | Nov. | 7.96 | 9.08 | 9.73 | |
| May | 13.34 | 8.50 | 9.56 | 10.33 | Dec. | 8.26 | 8.72 | 10.97 | |
| June | 12.70 | 8.38 | 9.88 | 10.72 | Average for Year | 11.44 | 8.66 | 9.46 | |
| July | 12.26 | 8.85 | 9.71 | 10.42 | | | | | |

# Stocks of Crude Rubber

*(All figures are in long tons)*

## ON HAND OR AFLOAT TO THE U. S.

| End of: | ON HAND 1938 | 1939 | 1940 | AFLOAT 1938 | 1939 | 1940 | ON HAND AND AFLOAT 1938 | 1939 | 1940 |
|---|---|---|---|---|---|---|---|---|---|
| Jan. | 276,497 | 220,727 | 142,368 | 57,356 | 48,210 | 90,285 | 333,853 | 268,937 | 232,653 |
| Feb. | 292,067 | 207,882 | 134,328 | 47,459 | 55,814 | 112,257 | 339,526 | 263,696 | 246,585 |
| Mar. | 301,762 | 201,752 | 142,414 | 41,882 | 55,981 | 113,619 | 343,644 | 257,733 | 256,033 |
| Apr. | 303,901 | 188,074 | 162,459 | 39,071 | 57,918 | 102,557 | 342,972 | 245,992 | 265,016 |
| May | 300,907 | 187,980 | 161,446 | 32,859 | 54,046 | 109,364 | 333,766 | 242,026 | 270,810 |
| June | 294,796 | 173,493 | 168,235 | 32,079 | 51,274 | 119,138 | 326,875 | 224,767 | 287,373 |
| July | 282,785 | 165,450 | 190,222 | 40,400 | 52,990 | 139,629 | 323,185 | 218,440 | 329,851 |
| Aug. | 273,841 | 152,029 | | 47,772 | 66,717 | | 321,613 | 218,746 | |
| Sept. | 268,094 | 136,824 | | 48,927 | 68,310 | | 317,021 | 205,134 | |
| Oct. | 259,074 | 119,404 | | 51,062 | 100,500 | | 310,136 | 219,904 | |
| Nov. | 242,592 | 105,205 | | 51,114 | 114,044 | | 293,706 | 219,249 | |
| Dec. | 231,500 | 125,800 | | 45,105 | 91,095 | | 276,605 | 216,895 | |

## STOCKS IN GREAT BRITAIN

*(No. of Tons in Wharves and Warehouses, not including Latex)*

| At end of | London 1938 | 1939 | 1940 | Liverpool 1938 | 1939 | 1940 |
|---|---|---|---|---|---|---|
| January | 40,203 | 51,420 | 12,000* | 21,711 | 28,789 | 8,000* |
| February | 46,596 | 48,312 | 10,000* | 24,737 | 26,784 | 7,000* |
| March | 50,233 | 46,768 | 10,000* | 26,220 | 24,996 | 8,000* |
| April | 54,296 | 44,760 | 12,000* | 28,277 | 23,742 | 10,000* |
| May | 57,194 | 43,454 | 12,000* | 29,862 | 22,211 | 9,000* |
| June | 60,307 | 42,374 | 11,000* | 31,837 | 21,176 | 8,500* |
| July | 62,236 | 37,772 | 15,500* | 32,825 | 19,116 | 11,000* |
| August | 65,113 | 28,363 | | 34,315 | 16,218 | |
| September | 63,321 | 24,965* | | 34,645 | 14,054* | |
| October | 59,609 | 23,685* | | 33,483 | 13,336* | |
| November | 57,794 | 23,244* | | 32,116 | 13,087* | |
| December | 55,668 | 19,545* | | 31,012 | 11,006* | |

* Estimated.

*(Figures up to August, 1939, from the Rubber Trade Association of London)*

## STOCKS IN OTHER CENTRES

*(Figures from Statistical Bulletin of the Int'l Rubber Regulation Committee)*

| | Penang and Singapore [1] | Malaya [2] | Ceylon [2] | Holland | Para and Manaos |
|---|---|---|---|---|---|
| At end of 1939 | | | | | |
| March | 23,255 | 58,005 | 3,389 | 137 | 2,244* |
| April | 22,434 | 55,238 | 3,648 | 131 | 2,209 |
| May | 20,849 | 52,837* | 4,005 | 136 | 1,966 |
| June | 19,563* | 55,834 | 3,771 | 101 | 1,821 |
| July | 27,042 | 55,948 | 4,217 | 188 | 1,474 |
| August | 20,543* | 50,625 | 3,134 | 315 | 1,914 |
| September | 23,457* | 52,755 | 2,742 | ... | 2,682 |
| October | 25,376* | 46,264 | 3,335 | ... | 3,419 |
| November | 22,957* | 45,133 | 5,289 | ... | 4,510 |
| December | 15,299* | 54,868 | 5,149 | ... | 5,336 |
| At end of 1940 | | | | | |
| January | 35,928 | 60,504 | 5,755 | .... | 2,862 |
| February | 33,563* | 52,615 | 4,452 | .... | 2,869 |
| March | 23,830* | 48,180 | 3,369 | .... | 3,246 |
| April | 42,239 | 50,656 | 4,749 | .... | 2,715 |
| May | 32,770 | 45,715 | 3,774 | .... | 1,743 |

[1] Dealers' and Port Stocks. [2] Inside Regulated Areas. [3] Dealers' Stocks Only. * Revised.

## RUBBER STOCKS AFLOAT

| | Afloat for United States | Afloat for Europe | All Other * Afloat | Total * Afloat |
|---|---|---|---|---|
| End of: 1939 | | | | |
| July | 52,990 | 31,000 | 21,010 | 105,000 |
| August | 66,717 | 30,000 | 23,283 | 120,000 |
| September | 68,310 | 30,000 | 35,690 | 134,000 |
| October | 100,500 | 35,000 | 37,500 | 173,000 |
| November | 114,044 | 35,000 | 21,956 | 171,000 |
| December | 91,095 | 35,000 | 25,905 | 152,000 |
| End of: 1940 | | | | |
| January | 90,285 | 40,000 | 44,715 | 175,000 |
| February | 112,257 | 40,000 | 40,743 | 193,000 |
| March | 113,619 | 45,000 | 52,381 | 211,000 |
| April | 102,557 | 45,000 | 40,443 | 188,000 |
| May | 109,364 | 45,000 | 55,636 | 210,000 |
| June | 119,138 | 50,000 | 65,862 | 235,000 |
| July | 139,629 | 55,000 | 55,371 | 250,000 |

* *Total afloat* is an arbitrary estimate based on number of months' shipments as adopted by the Department of Commerce. *All Other Afloat* is determined by subtracting the amount of stocks in transit to the United States and Europe from the estimated total.

## TOTAL PRINCIPAL WORLD STOCKS

*(Figures from the Survey of Current Business)*

| At End of: | 1935 | 1936 | 1937* | 1938* | 1939 | 1940 |
|---|---|---|---|---|---|---|
| January | 698,153 | 600,479 | 454,249 | 549,762 | 497,665 | 433,841 |
| February | 686,195 | 599,355 | 445,265 | 565,833 | 479,578 | 429,551 |
| March | 678,809 | 583,318 | 447,856 | 586,666 | 460,723 | 447,472 |
| April | 677,006 | 567,172 | 428,249 | 586,291 | 438,252 | 465,345 |
| May | 677,569 | 541,871 | 413,134 | 568,158 | 429,979 | 470,981 |
| June | 671,525 | 520,255 | 434,250 | 573,136 | 407,640 | 500,774 |
| July | 679,061 | 519,074 | 445,782 | 580,654 | 418,639 | 547,708 |
| August | 680,644 | 500,520 | 457,462 | 565,394 | 397,345 | ..... |
| September | 661,509 | 493,585 | 470,768 | 551,447 | 396,867 | ..... |
| October | 655,000 | 486,159 | 479,398 | 540,976 | 413,274 | ..... |
| November | 617,300 | 466,491 | 493,266 | 512,196 | 395,217 | ..... |
| December | 613,987 | 466,576 | 545,533 | 482,852 | 391,125 | ..... |
| Monthly Avge. | 666,397 | 528,738 | 460,022 | 555,280 | 427,192 | ..... |

* Revised.

# U. S. Tire and Tube Statistics[1]

*(All Figures Represent Thousands)*

## AUTOMOBILE CASINGS

| Quarter | Production Figures on Quarterly Basis 1933 | 1934 | 1935 | 1936 | 1937 | 1938 | 1939 | 1940 |
|---|---|---|---|---|---|---|---|---|
| Jan.-Mar. | 6,635 | 13,437 | 13,355 | 11,376 | 15,565 | 7,314 | 13,946 | 14,849 |
| Apr.-June | 14,412 | 13,565 | 12,597 | 14,892 | 15,834 | 7,380 | 13,759 | 15,648 |
| July-Sept. | 14,707 | 9,822 | 11,312 | 14,914 | 12,207 | 10,794 | 15,182 | ..... |
| Oct.-Dec. | 9,550 | 10,406 | 12,099 | 14,858 | 9,704 | 12,360 | 14,726 | ..... |
| Total | 45,304 | 47,230 | 49,363 | 56,040 | 53,310 | 37,848 | 57,613 | ..... |

| Quarter | Shipment Figures on Quarterly Basis 1933 | 1934 | 1935 | 1936 | 1937 | 1938 | 1939 | 1940 |
|---|---|---|---|---|---|---|---|---|
| Jan.-Mar. | 6,981 | 10,730 | 11,154 | 10,554 | 14,143 | 7,388 | 12,445 | 12,728 |
| Apr.-June | 15,139 | 14,998 | 13,473 | 15,940 | 15,741 | 9,564 | 15,107 | 17,449 |
| July-Sept. | 13,707 | 11,648 | 13,489 | 14,037 | 13,106 | 11,243 | 15,791 | ..... |
| Oct.-Dec. | 8,265 | 9,310 | 12,066 | 12,855 | 10,495 | 12,098 | 14,165 | ..... |
| Total | 44,092 | 46,686 | 50,182 | 53,386 | 53,485 | 40,293 | 57,508 | ..... |

| Quarter | Inventory Figures [2] 1933 | 1934 | 1935 | 1936 | 1937 | 1938 | 1939 | 1940 |
|---|---|---|---|---|---|---|---|---|
| Jan.-Mar. | 7,290 | 11,651 | 11,675 | 8,762 | 12,004 | 10,547 | 9,963 | 10,747 |
| Apr.-June | 6,615 | 10,219 | 10,755 | 7,556 | 12,081 | 8,337 | 8,632 | 8,985 |
| July-Sept. | 7,595 | 8,419 | 8,288 | 8,690 | 11,200 | 7,859 | 8,080 | ..... |
| Oct.-Dec. | 8,888 | 9,455 | 8,196 | 10,717 | 10,383 | 8,166 | 8,665 | ..... |

### Figures for Recent Months

| | PRODUCTION 1938 | 1939 | 1940 | SHIPMENTS 1938 | 1939 | 1940 | INVENTORY [2] 1938 | 1939 | 1940 |
|---|---|---|---|---|---|---|---|---|---|
| July | 3,346 | 4,595 | 4,854 | 3,907 | 5,143 | 4,348 | 8,041 | 8,103 | 9,345 |
| Aug. | 4,111 | 5,511 | .... | 4,011 | 4,990 | .... | 8,217 | 8,691 | .... |
| Sept. | 3,986 | 5,076 | .... | 3,938 | 5,658 | .... | 8,022 | 8,080 | .... |

## AUTOMOBILE INNER TUBES

| Quarter | Production Figures on Quarterly Basis 1933 | 1934 | 1935 | 1936 | 1937 | 1938 | 1939 | 1940 |
|---|---|---|---|---|---|---|---|---|
| Jan.-Mar. | 6,230 | 12,823 | 12,553 | 11,891 | 15,831 | 7,314 | 12,383 | 12,815 |
| Apr.-June | 13,001 | 13,191 | 11,631 | 14,624 | 15,413 | 7,380 | 11,847 | 13,704 |
| July-Sept. | 14,356 | 10,321 | 11,270 | 15,320 | 12,038 | 10,794 | 13,118 | ..... |
| Oct.-Dec. | 9,000 | 9,891 | 12,425 | 15,201 | 9,092 | 12,360 | 13,300 | ..... |
| Total | 42,587 | 46,226 | 47,879 | 57,036 | 52,374 | 37,848 | 50,648 | ..... |

| Quarter | Shipment Figures on Quarterly Basis 1933 | 1934 | 1935 | 1936 | 1937 | 1938 | 1939 | 1940 |
|---|---|---|---|---|---|---|---|---|
| Jan.-Mar. | 6,539 | 10,640 | 11,252 | 11,367 | 14,606 | 7,387 | 11,422 | 11,684 |
| Apr.-June | 13,292 | 14,553 | 11,928 | 15,113 | 15,495 | 9,564 | 13,010 | 14,957 |
| July-Sept. | 13,370 | 11,545 | 13,251 | 15,069 | 12,901 | 11,243 | 13,449 | ..... |
| Oct.-Dec. | 8,189 | 8,306 | 11,636 | 12,874 | 9,765 | 12,099 | 13,309 | ..... |
| Total | 41,390 | 45,044 | 48,067 | 54,423 | 52,767 | 40,293 | 51,190 | ..... |

| Quarter | Inventory Figures [2] 1933 | 1934 | 1935 | 1936 | 1937 | 1938 | 1939 | 1940 |
|---|---|---|---|---|---|---|---|---|
| Jan.-Mar. | 6,369 | 10,244 | 10,406 | 8,660 | 11,993 | 10,547 | 8,752 | 8,247 |
| Apr.-June | 6,097 | 8,795 | 10,050 | 8,075 | 11,833 | 8,337 | 7,549 | 6,914 |
| July-Sept. | 7,008 | 7,639 | 7,565 | 8,595 | 11,326 | 7,859 | 7,206 | ..... |
| Oct.-Dec. | 7,815 | 9,180 | 8,231 | 10,945 | 10,312 | 8,166 | 7,036 | ..... |

### Figures for Recent Months

| | PRODUCTION 1938 | 1939 | 1940 | SHIPMENTS 1938 | 1939 | 1940 | INVENTORY [2] 1938 | 1939 | 1940 |
|---|---|---|---|---|---|---|---|---|---|
| July | 2,936 | 3,905 | 4,026 | 3,519 | 4,150 | 3,735 | 7,723 | 7,323 | 7,198 |
| Aug. | 4,026 | 4,757 | .... | 3,744 | 4,309 | .... | 8,029 | 7,799 | .... |
| Sept. | 3,832 | 4,457 | .... | 3,980 | 4,991 | .... | 7,859 | 7,206 | .... |

[1] These figures are based on reports received from the Rubber Manufacturers Association. They are revised frequently and the latest available issue should be consulted for most reliable figures.
[2] Stocks held by manufacturers at end of period indicated.

# Automobile Production

| Year | United States Total | Passenger Cars | Trucks | Canada Total | Passenger Cars | Trucks | Grand Total |
|---|---|---|---|---|---|---|---|
| 1929 | 5,358,420 | 4,587,400 | 771,020 | 263,295 | 207,498 | 55,797 | 5,621,715 |
| 1930 | 3,355,986 | 2,814,452 | 540,534 | 154,192 | 125,442 | 28,750 | 3,510,178 |
| 1931 | 2,389,730 | 1,973,090 | 416,640 | 82,621 | 63,477 | 19,144 | 2,472,351 |
| 1932 | 1,370,678 | 1,135,493 | 235,187 | 60,816 | 50,718 | 10,098 | 1,431,494 |
| 1933 | 1,920,057 | 1,573,512 | 346,545 | 65,924 | 53,855 | 12,069 | 1,992,126 |
| 1934 | 2,753,111 | 2,177,919 | 575,192 | 116,852 | 92,647 | 24,205 | 2,869,963 |
| 1935 | 3,946,934 | 3,252,244 | 694,690 | 172,877 | 135,562 | 37,315 | 4,119,811 |
| 1936 | 4,454,115 | 3,669,528 | 784,587 | 162,159 | 128,369 | 33,790 | 4,616,274 |
| 1937 | 4,808,974 | 3,915,889 | 893,085 | 207,463 | 153,046 | 54,417 | 5,016,437 |
| 1938 | 2,489,085 | 2,000,985 | 488,100 | 166,086 | 123,761 | 42,325 | 2,655,171 |
| 1939* | 3,577,292 | 2,866,796 | 710,496 | 155,316 | 108,806 | 46,510 | 3,732,608 |
| 1940 | | | | | | | |
| Jan.* | 432,279 | 362,897 | 69,382 | 17,213 | 12,579 | 4,634 | 449,492 |
| Feb.* | 404,032 | 337,756 | 66,276 | 18,193 | 12,779 | 5,414 | 422,225 |
| Mar.* | 423,620 | 352,922 | 70,698 | 16,612 | 12,025 | 4,587 | 440,232 |
| Apr. | 432,746 | 362,139 | 70,607 | 19,687 | 13,487 | 6,200 | 452,433 |
| May | 391,215 | 325,676 | 65,539 | 21,277 | 12,677 | 8,600 | 412,492 |
| June | 344,636 | 286,040 | 58,596 | 17,930 | 8,739 | 9,191 | 362,566 |
| July | 231,703 | 168,769 | 62,934 | 14,468 | 3,397 | 11,071 | 246,171 |
| August | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| September | ..... | ..... | ..... | ..... | ..... | ..... | ..... |

* Revised.
Note: U. S. figures represent factory sales; Canadian figures represent production.

# Exports of Crude Rubber from Principal Producing Countries

**(Long Tons)**

| | BRITISH MALAYA [1] | | | | | | | NETHERLAND INDIES [4] | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gross Exports | Imports | Net Exports | Ceylon [2] | India & Burma [3] | Sarawak [3] | British North Borneo [3] | Thailand [3] | Java & Madura | Sumatra E. Coast | Other N. I. | Indo-China [3] | Amazon Valley | All Other [5] | World Total [6] |
| 1923 | 232,016 | 70,432 | 181,584 | 39,971 | 6,416 | 5,705 | 4,237 | 1,718 | 32,930 | 46,344 | 57,822 | 5,067 | 16,765 | 7,856 | 406,415 |
| 1924 | 259,706 | 108,524 | 151,182 | 39,997 | 7,697 | 6,699 | 4,621 | 2,962 | 42,446 | 54,497 | 80,347 | 6,688 | 23,165 | 9,065 | 429,366 |
| 1925 | 316,825 | 158,022 | 158,803 | 49,566 | 10,082 | 5,424 | 5,377 | 5,377 | 46,757 | 63,499 | 120,626 | 7,881 | 25,298 | 13,797 | 514,487 |
| 1926 | 391,328 | 151,243 | 240,085 | 58,962 | 9,874 | 9,155 | 6,079 | 4,027 | 52,186 | 71,413 | 121,231 | 8,203 | 24,298 | 16,017 | 621,536 |
| 1927 | 371,322 | 182,845 | 188,477 | 55,356 | 11,321 | 10,923 | 6,582 | 5,472 | 55,297 | 77,815 | 142,171 | 8,645 | 28,782 | 15,633 | 606,474 |
| 1928 | 409,430 | 149,787 | 259,643 | 57,267 | 10,790 | 10,087 | 6,698 | 4,813 | 58,848 | 82,511 | 121,770 | 9,548 | 21,129 | 10,690 | 653,794 |
| 1929 | 574,836 | 163,092 | 411,744 | 81,584 | 11,663 | 11,077 | 7,381 | 5,018 | 65,990 | 87,789 | 134,037 | 9,696 | 21,148 | 6,767 | 853,894 |
| 1930 | 547,043 | 133,876 | 413,167 | 76,970 | 10,782 | 10,309 | 6,781 | 4,251 | 69,755 | 79,396 | 115,254 | 7,665 | 14,260 | 5,651 | 814,241 |
| 1931 | 519,740 | 125,506 | 394,234 | 61,769 | 8,470 | 10,451 | 6,247 | 4,218 | 75,952 | 87,747 | 116,009 | 11,696 | 12,121 | 3,292 | 792,203 |
| 1932 | 478,252 | 92,539 | 385,713 | 48,973 | 3,888 | 6,960 | 4,604 | 3,451 | 61,312 | 79,837 | 85,871 | 13,883 | 6,450 | 1,816 | 702,818 |
| 1933 | 573,412 | 167,377 | 406,035 | 63,351 | 4,527 | 10,874 | 7,555 | 7,765 | 73,851 | 91,861 | 149,659 | 18,394 | 9,883 | 2,737 | 846,312 |
| 1934 | 677,361 | 211,803 | 465,558 | 79,746 | 10,492 | 17,233 | 11,103 | 17,545 | 87,400 | 112,058 | 175,470 | 20,170 | 8,903 | 2,985 | 1,008,663 |
| 1935 | 590,319 | 174,652 | 415,667 | 54,316 | 13,968 | 19,465 | 8,883 | 28,327 | 57,488 | 78,325 | 139,297 | 28,816 | 11,275 | 8,745 | 864,574 |
| 1936 | 520,286 | 167,799 | 352,487 | 49,692 | 14,724 | 21,243 | 8,177 | 33,702 | 61,307 | 84,577 | 152,205 | 40,782 | 14,193 | 11,466 | 845,431 |
| 1937 | 681,638 | 213,446 | 468,192 | 70,353 | 17,015 | 23,922 | 13,213 | 5,551 | 84,085 | 139,632 | 207,863 | 43,399 | 15,576 | 13,063 | 1,133,864 |
| 1938 | 526,911 | 156,101 | 370,810 | 49,528 | 15,178 | 17,792 | 9,512 | 41,080 | 57,526 | 94,501 | 145,909 | 58,518 | 14,618 | 12,920 | 887,892 |
| 1939 | 553,324 | 177,851 | 375,473 | 61,026 | 15,881 | 24,014 | 11,864 | 41,266 | 72,786 | 117,791 | 181,272 | 65,140 | 13,892 | 22,224 | 1,002,629 |
| 1939: | | | | | | | | | | | | | | | |
| Apr. | 43,658 | 13,996 | 29,662 | 2,225 | 1,260 | 2,446 | 1,687 | 2,660 | 5,321 | 9,250 | 13,768 | 2,581 | 1,139 | 1,753 | 73,751 |
| May | 42,214 | 12,697 | 29,517 | 2,805 | 1,670 | 1,649 | 558 | 2,782 | 4,105 | 8,168 | 12,155 | 4,585 | 874 | 1,672 | 70,540 |
| June | 31,541 | 9,567 | 21,974 | 3,708 | 1,435 | 1,157 | 332 | 1,748 | 5,839 | 8,846 | 12,824 | 4,030 | 591 | 1,825 | 64,309 |
| July | 45,962 | 20,052 | 25,910 | 5,019 | 1,285 | 3,092 | 1,603 | 5,599 | 5,229 | 11,020 | 19,431 | 3,367 | 1,019 | 1,804 | 84,378 |
| Aug. | 53,497 | 12,635 | 40,862 | 5,620 | 416 | 1,749 | 975 | 5,230 | 6,236 | 10,010 | 11,232 | 7,020 | 1,197 | 1,525 | 92,072 |
| Sept. | 45,094 | 18,302 | 26,792 | 6,064 | 780 | 1,932 | 429 | 4,670 | 5,168 | 10,278 | 22,270 | 5,943 | 1,131 | 1,832 | 87,289 |
| Oct. | 70,839 | 21,493 | 49,346 | 5,234 | 815 | 2,487 | 1,730 | 2,047 | 9,950 | 13,645 | 21,404 | 5,022 | 1,414 | 2,185 | 115,279 |
| Nov. | 49,276 | 13,657 | 35,619 | 4,405 | 819 | 2,023 | 1,322 | 1,428 | 5,827 | 10,239 | 14,163 | 6,540 | 1,055 | 2,191 | 85,631 |
| Dec. | 41,568 | 8,479 | 33,089 | 9,496 | 2,565 | 2,476 | 616 | 1,177 | 8,130 | 8,580 | 7,156 | 11,018 | 1,377 | 2,052 | 87,732 |
| 1940: | | | | | | | | | | | | | | | |
| Jan. | 56,214 | 30,136 | 26,078 | 7,091 | 1,630 | 1,987 | 1,858 | 5,469 | 6,361 | 16,070 | 31,676 | 5,315 | 1,777 | 2,000* | 107,212 |
| Feb. | 62,105 | 16,598 | 45,507 | 8,741 | 2,076 | 2,678 | 1,164 | 3,887 | 7,270 | 14,873 | 15,713 | 7,040 | 1,781 | 2,000* | 112,376 |
| Mar. | 65,269 | 17,565 | 47,704 | 5,406 | 2,054 | 3,526 | 1,050 | 3,111 | 8,864 | 13,415 | 20,015 | 3,551 | 1,298 | 2,000* | 111,994 |
| Apr. | 47,430 | 22,106 | 25,324 | 4,309 | 2,173 | 2,951 | 1,799 | 1,834 | 7,703 | 12,759 | 23,815 | 2,927 | 1,582 | 2,000* | 89,206 |
| May | 74,682 | 16,946 | 57,736 | 7,274 | 2,229 | 2,696 | 1,370 | 2,582 | 8,416 | 11,904 | 20,009 | 4,000* | 3,413 | 2,000* | 121,629 |
| June | 60,814 | 15,529 | 45,285 | 5,597 | 1,896 | 4,077 | 1,421 | 3,000* | 9,830 | 14,616 | 20,104 | 4,000* | 1,045 | 2,000* | 112,871 |
| July | 70,360 | 27,625 | 42,735 | 7,580 | 1,567 | 2,494 | 1,767 | 3,000* | 13,340* | 19,840* | 27,283* | 4,000* | 1,321 | 2,000* | 126,927 |

All figures from January, 1934, onward are net exports shown on a "dry rubber" basis as calculated by the International Rubber Regulation Committee. (1) Prior to January, 1934, Malayan net exports cannot be taken as production, since imported rubber is largely wet native rubber, which is reduced about one-third in weight by remilling; rubber exported as latex also is not included in the early years, which on a dry rubber basis was as follows: 1924—1,117 tons; 1925—3,618; 1926—3,263; 1927—2,439; 1928—2,247; 1929—3,574; 1930—2,750; 1931—1,940; 1932—5,193; 1933—10,470, and 1934—14,172 tons. (2) Ceylon Chamber of Commerce statistics until 1926; rubber exported as latex is not included—such shipments on a dry rubber basis were: 1923—18 tons; 1924—90; 1925—6; 1926—20; 1927—½; 1928—1; 1929—2; 1930—11; 1931—2; 1932—2; 1933—1, and 1934—6 tons. (3) Official statistics. (4) Exports from "Other N. I." are chiefly wet native rubber, which is reduced about one-third in weight by remilling; rubber exported as latex is not included in earlier years, which is as follows on a dry rubber basis: 1923—2,342 tons; 1924—1,008; 1925—2,239; 1926—44; 1927—84; 1928—1,395; 1929—437; 1930—2,744; 1931—3,874; 1932—3,488; 1933—5,260, and 1934—5,330 tons. (5) Calculated from official import statistics of principal consuming countries; also includes United States imports of guayule. (6) This total includes the third column for British Malaya and all other figures shown for other territories. (*) Figure is provisional.

NOTE: ANNUAL FIGURES ARE MORE ACCURATE: THEY ARE REVISED AT THE END OF THE FOLLOWING YEAR.

# Net Imports of Crude Rubber into Principal Manufacturing Countries

***(Long Tons)***

| | United States [1] | United Kingdom | France (h) | Germany | Canada (ac) | Japan (da) | Italy | Russia (ce) | Australia (cd) | Belgium (d) | Netherlands | Scandinavia (abcdf) | Spain (g) | Czechoslovakia (abcd) | World Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1919 | 238,407 | 42,671 | 17,685 | 5,584 | 6,395 | 9,753 | 9,894 | 75 | 1,002 | 3,995 | 2,771 | 3,149 | 2,418 | 9 | 343,808 |
| 1920 | 249,530 | 56,844 | 13,885 | 11,890 | 11,746 | 5,297 | 6,123 | 62 | 1,815 | 3,840 | 5,510 | 2,292 | 2,008 | 567 | 371,409 |
| 1921 | 179,736 | 42,087 | 15,135 | 21,920 | 8,124 | 21,713 | 3,906 | 165 | 1,014 | 1,705 | 1,022 | 1,279 | 2,245 | 569 | 300,620 |
| 1922 | 296,594 | 11,724 | 24,352 | 27,546 | 9,207 | 15,934 | 6,430 | 2,493 | 2,643 | 172 | —3,807 | 1,778 | 589 | 567 | 396,222 |
| 1923 | 301,527 | 12,700 | 27,392 | 18,519 | 13,277 | 15,372 | 8,489 | 2,986 | 1,649 | 2,184 | 792 | 2,528 | 630 | 1,128 | 409,173 |
| 1924 | 319,103 | —11,550 | 30,446 | 22,727 | 14,299 | 19,571 | 8,764 | 2,346 | 3,124 | 2,688 | —807 | 3,178 | 944 | 1,370 | 416,203 |
| 1925 | 385,596 | 4,061 | 32,956 | 33,937 | 19,683 | 11,117 | 11,412 | 7,088 | 4,757 | 2,930 | 875 | 3,149 | 1,155 | 1,558 | 520,274 |
| 1926 | 399,981 | 84,865 | 34,240 | 22,773 | 20,229 | 18,125 | 9,809 | 6,529 | 9,021 | 2,498 | 2,670 | 4,046 | 1,299 | 1,870 | 617,957 |
| 1927 | 403,472 | 60,249 | 34,271 | 38,892 | 26,405 | 20,521 | 11,381 | 12,018 | 9,490 | 6,482 | 636 | 4,224 | 2,055 | 2,672 | 632,768 |
| 1928 | 407,572 | 4,846 | 36,498 | 37,855 | 30,447 | 25,621 | 12,433 | 15,134 | 8,430 | 7,958 | 2,243 | 4,418 | 3,178 | 3,138 | 599,771 |
| 1929 | 528,608 | 122,675 | 55,093 | 49,275 | 35,453 | 34,284 | 17,169 | 11,774 | 15,886 | 9,445 | 3,022 | 6,440 | 864 | 4,650 | 894,638 |
| 1930 | 458,036 | 120,069 | 68,503 | 45,488 | 28,793 | 33,039 | 18,639 | 16,387 | 5,354 | 10,635 | 2,924 | 7,710 | 2,400 | 4,468 | 822,445 |
| 1931 | 475,993 | 86,170 | 46,466 | 39,688 | 25,261 | 43,483 | 10,149 | 30,671 | 7,649 | 11,009 | 2,220 | 6,360 | 2,605 | 7,717 | 794,641 |
| 1932 | 393,844 | 44,086 | 42,506 | 45,121 | 20,917 | 56,027 | 14,469 | 30,637 | 12,576 | 9,519 | 2,851 | 7,262 | 4,359 | 9,444 | 693,618 |
| 1933 | 398,365 | 73,335 | 61,953 | 54,120 | 19,332 | 66,831 | 19,341 | 29,830 | 13,534 | 11,166 | 1,243 | 7,831 | 5,520 | 10,402 | 772,803 |
| 1934 | 439,172 | 158,482 | 49,560 | 59,330 | 28,439 | 69,905 | 21,398 | 47,271 | 9,642 | 9,115 | 3,758 | 12,418 | 6,900 | 10,999 | 926,389 |
| 1935 | 455,758 | 128,829 | 51,450 | 62,899 | 26,870 | 57,567 | 21,880 | 37,572 | 9,978 | 7,593 | 4,068 | 11,878 | 8,140 | 11,245 | 895,727 |
| 1936 | 475,359 | —2,591 | 57,032 | 71,794 | 27,871 | 61,223 | 16,534 | 30,967 | 14,109 | 9,648 | 2,888 | 11,236 | 6,668 | 8,772 | 791,510 |
| 1937 | 592,394 | 92,707 | 59,871 | 98,170 | 36,088 | 62,311 | 24,733 | 30,462 | 19,164 | 14,970 | 4,343 | 4,680 | 2,400 | 13,663 | 1,055,356 |
| 1938 | 406,343 | 133,079 | 59,660 | 90,200 | 25,696 | 45,836 | 28,170 | 25,650 | 11,944 | 11,309 | 5,092 | 16,034 | 2,400 | 9,936 | 871,349 |
| 1939: | | | | | | | | | | | | | | | |
| Apr. | 31,590 | 4,752 | 5,639 | 8,719 | 1,466 | 3,579 | 1,926 | 2,000* | 1,108 | 855 | 333 | 1,062 | 200* | 597 | 63,826 |
| May | 45,390 | 7,531 | 4,646 | 8,413 | 3,006 | 4,438 | 1,573 | 2,000* | 1,188 | 792 | 518 | 1,654 | 200* | 618 | 81,967 |
| June | 33,951 | 8,439 | 4,649 | 8,190 | 2,423 | 3,067 | 1,992 | 2,000* | 1,308 | 621 | 672 | 2,703 | 200* | 487 | 70,702 |
| July | 36,932 | 4,040 | 4,282 | 8,437 | 3,164 | 3,668 | 1,350 | 1,000* | 1,422 | 859 | 565 | 824 | 200* | 412 | 67,155 |
| Aug. | 38,319 | 2,044 | 4,000* | .... | 2,033 | 3,145 | 1,500* | 2,000* | 2,182 | 952 | 651 | 1,546 | 200* | 400* | 58,972 |
| Sept. | 36,197 | 4,406 | 4,000* | .... | 2,639 | 9,254 | 1,500* | 2,000* | 875 | 108 | 222 | 1,200* | 200* | ... | 63,572 |
| Oct. | 39,735 | 8,530 | 5,000* | .... | 3,787 | 2,749 | 1,500* | 2,000* | 1,235 | 519 | 653 | 1,200* | 200* | ... | 69,589 |
| Nov. | 41,478 | 10,500* | 5,000* | .... | 1,709 | 5,104 | 1,500* | 2,000* | 1,200* | 667 | 613 | 1,200* | 200* | ... | 71,504 |
| Dec. | 70,302 | 5,200* | 5,000* | .... | 3,025 | 3,961 | 1,500* | 2,000* | 1,200* | 1,035 | 1,827 | 1,200* | 200* | ... | 94,702 |
| 1940: | | | | | | | | | | | | | | | |
| Jan. | 71,565 | 450 | 5,000* | .... | 5,047 | 4,540 | 1,500* | 2,000* | 1,200* | 891 | 682 | 1,200* | 200* | ..... | ..... |
| Feb. | 41,797 | 7,500 | 5,000* | .... | 3,508 | 5,241 | .... | .... | ..... | 694 | 495 | 1,200* | 200* | ..... | ..... |
| Mar. | 58,302 | 14,200 | .... | ..... | 3,062 | 6,057 | .... | ..... | ..... | ..... | 627 | ..... | ..... | ..... | ..... |
| Apr. | 70,135 | 16,400 | .... | ..... | 3,096 | .... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| May | 50,610 | 10,000 | .... | .... | 3,108 | .... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| June | 53,266 | 9,500 | .... | .... | .... | .... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| July | 69,374 | 19,500 | .... | .... | .... | .... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |

a—Including gutta percha. b—Including balata. c—Re-exports not deducted in monthly statistics. d—Including some scrap and reclaimed rubber. e—Official statistics of rubber imports by Soviet Russia. f—Including Norway, Sweden, Denmark and Finland. g—United Kingdom and French exports to Spain except in years prior to 1925. h—French imports have been reduced in order to eliminate imports of gutta percha and to reduce to basis of net weight. [1]—United States imports of guayule are included in this compilation. *—Figure is provisional; final figure will be shown when available.

NOTE: ANNUAL FIGURES ARE MORE ACCURATE: THEY ARE REVISED AT THE END OF THE FOLLOWING YEAR.

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